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OF

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INDEX

Vol. 7, 1930.

SUBJECT INDEX.

A.

B.

C.

AUTHORS INDEX.

G.

J.

L.

Mc.

M.

N.

P.

V.

W.

ARTICLES ILLUSTRATED.

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A SYSTEMATIC CENSUS OF WEST AUSTRALIAN FLORA.

EDITOR.

With the March issue of the "Journal of the Department of Agriculture" is included, in addition to the annual supplementary index to the last Volume, an appendix entitled "Enumeratio Plantarum Australiae Occidentalis," a work compiled by Mr. Chas. A. Gardner, the Government Botanist.

This appendix will form a valuable contribution to the science of Botany throughout the world, for it is worthy of note that no similar publication of this nature has hitherto been issued concerning the flora of the State. The only comprehensive journal attempting to embody the knowledge now diffused is the "Flora Australienesis," issued between the years 1860 and 1878. All other botanical contributions to the literature consist of small books, or odd papers published in very many journals in England, Australia and foreign countries—notably Germany. The student of botany in this country can scarcely hope to accumulate all these: hence the purpose of this census.

Mr. Gardner has succeeded in including the names of all plants occurring within the political borders of the State in systematic order, and in such a manner that all closely related plants are brought together. The student, comparing Bentham's work ("Flora Australienesis") with the census now issued, would find in the latter names that do not occur in the former publication, and from their position or sequential order would be able to trace the description. The name of each species is followed by that of the person who described it, or the later authority who revised the name, followed again by the title of the periodical, paper, journal, or whatever it may be, in which the description may be found, together with the date of its publication. Wherever a name has a synonym it is included in italics, with brackets. Each genus is numbered in sequential order.

The census also includes all the exotic, naturalised species that have been recorded up to the present time, the genera of which are not numbered, but given in sequential order. The paper in which they are described is not mentioned, but the original home of each species is given in Latin. The name of each introduced plant is also preceded by an asterisk, and may be thus easily picked out.

The census has been in course of preparation since 1923, and every care has been exercised regarding the correct name and status of each species. The system followed is that in general use amongst botanists, being that of Engler, the famous German.

It is not contended that this work will be of particular value to the agriculturist or pastoralist, although something more than a superficial knowledge of the subject would be to their advantage, and, if included in their libraries for ready reference, there cannot fail to arise occasions when it will be found extremely useful. Readers of the "Journal," however, now cover a wide range throughout the Commonwealth and far beyond the limits of the Australian continent, and to many of them the census will be of far more than passing interest. By the botanist and student it will be welcomed and appreciated. For this reason, and that it constitutes in part a record of the work carried out by the Department of Agriculture for Western Australia, this publication takes pleasure in being the first medium to introduce this patiently compiled and comprehensive census to its reading public.

It is hoped to publish the work in four separate parts as an appendix, or supplement, to the quarterly issue, and the volume will be completed with the December number.

"THE JOURNAL OF AGRICULTURE"

will be supplied free *on application* to any person in the State who is following Agricultural, Horticultural, or Viticultural pursuits, to Agricultural Societies or Associations, and to any person otherwise interested in Agriculture.

A charge of Threepence per copy will be made for the *Journal* to persons other than the foregoing, or who do not reside in the State. These applications accompanied by the requisite amount, must be forwarded to the Director of Agriculture, Department of Agriculture, who will also receive all correspondence dealing with the conduct of the *Journal*.

Editors of agricultural and country papers are invited to reproduce any of the articles contained in this *Journal*, providing the usual acknowledgment is made.

If you are not receiving the *Journal*, which is issued quarterly, and wish to do so, please forward your name and postal address to the Director of Agriculture, Perth.

HISTORICAL.

A SHORT HORTICULTURAL AND AGRICULTURAL HISTORY OF THE PROGRESS OF ALBANY, MT. BARKER, AND THE ADJOINING DISTRICTS.

By A. C. VAUGHAN.

Though celebrating the Centenary Year of Western Australia, the progress of horticulture and agriculture in the above-mentioned districts has increased more rapidly during the last twenty-five years than in the seventy-five which preceded them, and it is with the latter part of the last quarter of a century this article proposes mainly to deal.

Horticulture has been largely responsible for developing the prosperity of these districts, and still holds its own from a viewpoint of production, for it was early realised that climatic conditions and suitability of soil were favourable to the planting of orchards, especially for the production of pip fruits.

When the opening up of the goldfields brought about an influx of population a good local market was created; it was recognised that conditions were favourable, with the result that the fruit growing industry went ahead. Thirty years ago there were few people who realised how important this industry was to become to Albany and its environs, yet to-day about one-third of the apple crop of the State is grown within their boundaries, and during this Centenary Year 223,128 cases of apples and 14,990 bushels of pears were exported overseas, necessitating nine ships calling at the Port of Albany. Besides this a large number of cases were sent to the Eastern States.

Years ago it was made apparent that cool storage had become a necessity and the Government came to the assistance of the growers by erecting one at Albany. Private enterprise followed the lead, and at Mt. Barker the Co-operative Fruit-growers of that district put up a very fine store. Both of these adjuncts have been of immense value to growers.

How the industry will increase in the next century one would be foolish to forecast, and will doubtless be governed by the demand for the product, but it is certain we have thousands of acres suitable for producing the best fruit that can be grown. At Mt. Barker, the leading centre, large areas of trees have been planted. The Mt. Barker Estate, now owned by Messrs. Martin Bros., has over 200 acres of orchard; Messrs. Sounnes and Sons well over 100 acres, and Mr. E. Thomas also over 100; while there are several orchards comprising 50 acres or more. The King and Kalgan River Districts have some nice orchards, while Kendenup, Torbay and Denmark also produce good fruit.

Since the export of fruit commenced the demand has been good. For the last three years overseas merchants have been buying at good prices f.o.b. Albany, the 1929 quotes being the highest yet offered. It looks, therefore, as if the fruit produced can hold its own in the world's markets. The comparative freedom from diseases is a big factor and the envy of Eastern visitors. Our Plant Diseases Act and its administration may justly be held largely responsible for this, and the growers of to-day have distinct advantages over those of thirty years ago as far as knowledge is concerned.

There has been no boom in planting in recent years, but production has steadily increased and promises to continue, Kendenup being the most

recent centre to plant extent of acreage, where the young orchards, just coming into bearing, look very well.

The history of the districts reviewed shows that fruit growing has been sound and profitable. While the future of the industry seems bright, there are indications that land development will depend on sound combinations of two or more industries proved suitable for certain districts. Mt. Barker and adjacent lands have proved their suitability for fruit growing, and are now proving that they have a second sound proposition in the cultivation of pasture.

It is very nice to be able to specialise in one industry, but the old saying, "Never have all your eggs in one basket," has a lot of followers. Pasture means production of wool, meat, hides, cream, etc., for all of which there is an assured market, allowing the farmer to go in for sheep or cattle, according to his inclination, the suitability of his land and its type. Mt. Barker is favouring fruit and sheep, and what may be described as standard farms are being evolved on the lines mentioned, either fruit or sheep predominating. Districts further South are favouring dairying and fruit, and potato growing.

The big drawbacks to settlement in timber country are cost of clearing and slowness of return whether the land is eventually to be used for horticulture or agriculture. The keynote of success is to cheapen capital costs and start on sound lines. For this three things are essential, viz., skill in clearing, a knowledge of manuring and soil improvement, and growing the right type of plant for the soil and climatic conditions.

It is admitted in horticulture—and applies also to agriculture in timber districts—that it is inadvisable to plant green country for cropping purposes. A system is now in practice which, though not perhaps generally accepted, promises to be of great value as a starting point in reducing capital costs and developing on sound lines. This is chiefly, in addition to ring-barking and suckering, sowing suitable seeds, mostly clovers, and top dressing with manure, with or without some sort of cultivation. The suckered green country treated in this way can be made to show a small return in the first year. This refers to country carrying principally Wandoo or White Gum timber.

The system being practised allows of several variations of method necessary to suit different kinds of country and the final purpose for which the land is to be tilled. Where Jarrah or Red Gum predominates, the country is ring-barked and small saplings and scrub cut down, and every effort made to get what is called a clean burn. This is followed up by sowing seeds and manure. The seeds should not be sown too early or they may germinate and wilt. Superphosphate at the rate of one bag per acre is recommended, with subterranean clover at the rate of 4-6 lbs. per acre in the seed mixture. In most places the choice of seed would include subterranean clover, but cluster, suckling, and drooping clover have proved their value for this type of work. Then by judicious grazing one can get a small quick return, as the clovers, with the natural herbage which exists in most country, give quite a fair picking the first year. Top dressing and suckering follow for such period as is necessary. Soil improvement is commenced, and in a few years the country can be cleared at a low cost, and when ploughed is fit for horticultural or agricultural purposes. Of course much of the poorer country will be kept for permanent pastures, but this work is likely to have a bearing on present classification and soil surveys and make profitable thousands of acres of land already provided with public facilities.

EXPORT OF EGGS.

REJECTS—THEIR CAUSES AND REMEDY.

By W. T. RICHARDSON,
Poultry Adviser and Commonwealth Officer in Charge of Export of Eggs.

The export of eggs overseas is subject to Regulations issued by the Commonwealth Government under the Customs Act, 1901-1925, and the Commercial (Trade Descriptions) Act, 1901-1925, and include both eggs in shell and egg pulp.

Eggs had been exported to England for a number of years prior to these regulations coming into force. They were packed in cases, on the farm, without supervision, and sent to the shipping agents for shipment. The first season the above regulations came into force (1927) showed how justified they were on account of the heavy rejects, through various causes, mainly dirty eggs. One can therefore picture the condition of previous export efforts.

Inspectors are now appointed whose duty it is to inspect all eggs submitted for export at the various approved packing sheds, and reject those not complying with regulation requirements. As "the exportation of eggs and egg pulp is prohibited unless such goods have first been graded and packed to the satisfaction of an officer of Customs in accordance with Regulations" (Proclamation 22/9/27).

Large numbers of poultry farmers not conversant with export requirements have suffered heavy rejects. Every successive season has been a marked improvement in the general condition of the eggs submitted for inspection.

To comply with English requirements the word "Australia" (country of origin) must now be stamped on every individual egg exported.

The Cause of Rejects has been—

Dirty eggs, which include:

- Eggs soiled with fowl excreta.
- Eggs soiled through breakages in transit to the packing sheds.
- Soiled through rust and grit picked up in transit and deposited on the dies of the fillers and on the "flats." Such eggs show rings of dust of varying magnitude, ground into the shell, also soiled ends (those resting on the flats).
- Yellow stains, caused by damp litter in the nests or houses, damp floors, excreta, damp ground, etc.
- Toe marks on the eggs.
- Eggs with chaff, sand, sawdust, etc., adhering to them.
- Eggs wiped with damp, dirty cloths that leave dirty streaks on the shell.

According to the Act the definition of "clean" reads as follows: "Clean, in relation to eggs in shell, means free from stain, dirt, or other foreign matter, but does not include eggs which have been washed." This is a definite instruction and does not allow for the very elastic interpretation of "reasonably" clean. What may appear reasonably clean to the producer or seller may not appear so to the purchaser.

It is difficult to have clean eggs (unwashed) during the winter months, unless proper housing for the laying birds is provided, with deep clean litter on raised, dry floors, clean resting material, etc., where the birds may be confined when necessary. Clay or loamy soils will aggravate this disability. The semi-intensive or intensive system of housing will help to solve this trouble. Eggs intended for export should be gathered at least twice a day.

Soiled eggs may be wiped with a clean damp cloth. Eggs showing evidence of washing in water are rejected.

When in transit. by road, the eggs should be well covered with a sheet or bags to protect them from dust as well as from rain or sun.

Stale Eggs:

Eggs with large air cells (indicates staleness) applies mostly to "country" eggs.

Eggs showing evidence of incubation.

Eggs with olive coloured yolks (a disease caused by bacteria that renders the egg unfit for human consumption).

Eggs with blood spots.

Eggs with the above defects are noted and rejected by the packing shed staff during the candling process. Any doubtful eggs are submitted to the Inspector for his decision.

Large quantities of stale country eggs (mostly "floor" eggs not intended for export) were rejected last season, which, otherwise, may have been exportable. Holding eggs by country producers or storekeepers is responsible for this condition. Partly incubated eggs should not find their way to the packing sheds. One particularly bad lot (incubator rejects) came from a farm within the metropolitan suburban area, marked "for export." Olive coloured yolks were very limited in numbers.

A greater percentage of eggs with blood spots came from the Fremantle district than from any other district, possibly due to overstimulating feeding.

Eggs with broken, unsound, or abnormal shells:

Broken eggs were numerous, through—

(a) careless handling of cases in transit;

(b) eggs too long for the fillers;

(c) eggs too stout for the fillers;

(d) thin-shelled eggs.

Cracked eggs, not noticeable except by candling.

Chalky shells (few in number).

Thin shells—a general fault that got worse as the season advanced. Some producers had heavy rejects on this score.

Abnormal shells, i.e., rough ridges round or partly round the egg, flat on one side; round eggs (cricket ball like), long thin eggs (torpedo shaped).

In this respect Regulations state: "No egg which has a broken or damaged shell, or which is in unsound or other abnormal condition, shall be packed."

With regard to broken eggs, greater care in the handling and carrying of eggs from the farm to the packing shed is self-suggestive. Eggs too long for the fillers should not be submitted for export, as they are liable to get broken. A broken egg may soil a number of others in the case. When packing, if the hand is passed over each "flat," any eggs too long for the filler will be readily felt Withdraw such eggs and replace them by others of suitable length. Eggs too stout for the fillers may break when packed on the farm or at the packing shed.

During the past export season the greatest percentage of rejects was due to shell weakness (thin shells). Eggs of this nature generally denote a deficiency in shell-forming material. Shell grit alone will not supply the necessary requirements during periods of heavy production. Those producers that followed the advice given them greatly improved the texture of the egg shells by adding 5 per cent. bone meal to the daily mash.

Mixing long, thin, or otherwise abnormal eggs with normal shaped ones spoils the uniform appearance of the pack and leads to their rejection.

Incorrect grading.

Laxity in this respect on the part of some producers has been so consistent that the Inspectors have had to refuse inspection of numerous case lots on account of poor or apparently no attempt at grading, unless regraded by the packing-shed staff. Producers must realise that the cost of candling, packing, etc., is pooled for the season and is a charge against them, therefore the careless person, whose eggs have to be regraded, is imposing on the producer who takes a pride in the quality and grade of egg submitted, by making him share in the extra cost of regrading. It is not the duty of an Inspector to regrade eggs, as will be seen by reference to the Proclamation quoted.

The various exportable grades are subject to a maximum and a minimum weight of egg, also to a minimum weight per each ten dozen eggs, and an Inspector cannot refuse to pass any of the gazetted grades provided they comply with the provisions of the Act. It is advisable to mention, in order to dispel erroneous impressions, that the cost of supervision and inspection connected with the export of eggs is solely borne by the Commonwealth Government, and therefore is not a charge against the egg producers.

With the object of assisting the producers to improve the condition, quality, grade, etc., of their product, and in order to help them submit the greatest number of exportable eggs, the Inspectors keep a detailed record of every parcel of eggs from each individual producer showing the nature of every reject.

These records, which are purely voluntary and involve a considerable amount of work, are available only to the producers concerned during the export season. It is regrettable that too many of them are content to forward to the packing sheds the same class of egg, with the same heavy rejects, week after week, without endeavouring to ascertain the cause, and its remedy, if any.

At the same time, a tribute must be paid to those poultry farmers who take a pride in the quality, appearance, etc., of their eggs, and suffer few rejects in consequence.

SEED TESTING.

ITS VALUE TO THE FARMER.

H. G. ELLIOTT, Dip. Agric.,
Assistant Plant Pathologist.

Owing to the extent of the development of world-wide competition in agricultural production during the past few years, the farmer has to eliminate every element of chance in farming practices to strengthen his position in this struggle.

The modern farmer cannot, to-day, use the out-of-date methods which were excusable in the early days, for then the cost of production was less while competition was negligible. Those obsolete methods should no longer be practised,—conditions are different, prices of seed higher and labour more expensive; in fact, the cost of production is greater in almost every respect, and consequently profits tend to diminish. An important factor in ensuring an increase of profits is the use of agricultural seeds of only good quality. This implies seed testing previous to buying or sowing.

The testing of seeds before sowing is by no means an innovation in the history of agricultural progress. As early as 1869 the first *Seed Control Station* was initiated by Dr. Nobbé in Saxony, and since that time similar stations have gradually extended over Europe. Two of the most outstanding are at Zurich (Switzerland) and Copenhagen (Denmark). These are regarded as the word's leading establishments in seed testing and much valuable research work has been done at both. Great Britain, Ireland, Canada, U.S.A., New Zealand and Australia have also been testing seed to a greater or less extent for many years. They each have established one or more seed testing stations.

Before the introduction of seed testing, farmers knew very little about the quality of the seed they bought for sowing. Scientific methods for ascertaining their value were unknown, consequenty they had to rely on simple unorthodox tests, such as appearance, smell, size and taste. These doubtful means of discrimination did not, however, satisfactorily demonstrate their value, as that can only be accurately determined by scientific testing.

It is essential for the farmer to understand that a good sample of seed should contain the largest possible quantity of the seed of the plant desired for growing, and consequently freedom from seeds of undesirable plants and inert matter such as chaff, soil particles, etc.,—in other words *as high a percentage of purity as can be obtained*: combined with this the seed should be capable of vigorous growth, *i.e.* should give *a high percentage of germination.*

It frequently occurs (and the explanation often troubles the farmers) that, after spending much time and money they obtain very disappointing crops, accompanied by a good stand of weeds many of which may be new to their areas. They do not always realise that the fault may be in the seed sown, and that the only way to safeguard against this is to have all the seed which is bought tested, or only to buy guaranteed tested samples. The introduction of new weeds on to a farm is serious, and should be avoided if possible. Unfortunately most weeds are free seeders (thereby producing a further heavier infestation next season) and loss in time and money eventually occurs in eradicating them.

The following points with respect to the purchase of seed should be considered by all farmers:—

1. Suitability for district, particularly as to kind and variety.
2. Freedom from and resistance to diseases.
3. Quality.
4. Purity.
5. Germination.

It is very probable that most growers consider the first before buying, but with regard to the others, it is certain that they are frequently overlooked. Progressive farmers, who recognise the importance of better and more profitable crop production, must realise, however, that the careful selection of seed under the points above enumerated is worthy of their attention.

This article is written with the purpose of encouraging farmers to buy and use the best seeds, also to convince them that they have no justification whatever for buying and using cheap and inferior seeds with a high proportion of weed seeds. The main points to be borne in mind are—

1. Seeds of some crops are unavoidably mixed with seeds of some undesirable weeds, which, when sown may gain the upper hand and reduce the stand of the main crop, consequently they will necessitate labour and expense in eradication to prevent permanent injury to the farm.
2. Old seed, which may have a low germination capacity, results in a poor crop, the field having throughout only scattered plants.
3. Seeds may have low germinating capacity, due to—
   (a) Unfavourable conditions during the development, harvesting, and storage of the seed: or
   (b) Seed that has been kept too long, *i.e.*, old age.
4. Seeds of certain crops such as lucerne, clovers, grasses, etc., found for sale, usually come from overseas countries which may have a vastly different climate to that under which they would be grown in this State, the ultimate results being reduction in yield of crop and carrying capacity of the pastures.

In the selection of seeds the following points should be looked for:—size, colour, plumpness, brightness (and occasionally smell), but it is not always easy to judge by the eye. Something more than good appearance is needed, and that is *high percentage purity and germination.*

In conclusion, the following points should be given careful consideration:—

Buy on tested samples and obtain a statement as to percentage purity and germination, which will tell what proportion of the bulk of the seed is true to name; note the nature of the impurities and especially the amount of weed seeds present. The germination will show the percentage of pure seeds which are capable of growth.

Avoid cheap seeds unless there is definite proof to show they are good, as *cheapness and inferiority* generally go together.

THE "ROYAL" AND DISTRICT AGRICULTURAL SOCIETIES' CROP COMPETITIONS.

I. THOMAS.
Superintendent of Wheat Farms.

The Royal Agricultural Society has promoted, during the past six years, competitions for wheat crops of not less than 50 acres of any one variety throughout the wheat belt.

For the purpose of the competition the wheat belt of the State was, as in former years, divided into eight zones. Formerly the zones were numbered one to eight. This, however, did not permit of the Esperance and Ravensthorpe districts taking an active interest in the competition as their climatic and other conditions differed greatly from those prevailing in the existing zones. In past competitions the competitors in Zone 6 were few. In view of this apparent lack of interest, and in order to create a new zone (No. 9) to embrace the Esperance and Ravensthorpe areas without increasing the number of zones, it was decided this year to include in Zone 8 the districts formerly in Zone 6.

The eight zones into which the wheat belt is divided are as shown in the accompanying map.

In each of the eight zones a championship prize is awarded: also a prize is awarded for the runner-up. Those competitors eligible for these prizes are the first and second prize winners of the competitions held by the affiliated district Agricultural Societies conducting crop competitions in accordance with the Royal Agricultural Society's conditions.

In some districts the Agricultural Societies make no provision for crop competitions, and in order to prevent farmers who are located in such districts being debarred from competing for the championship prizes in their respective zones, the Royal Agricultural Society accepts entries direct.

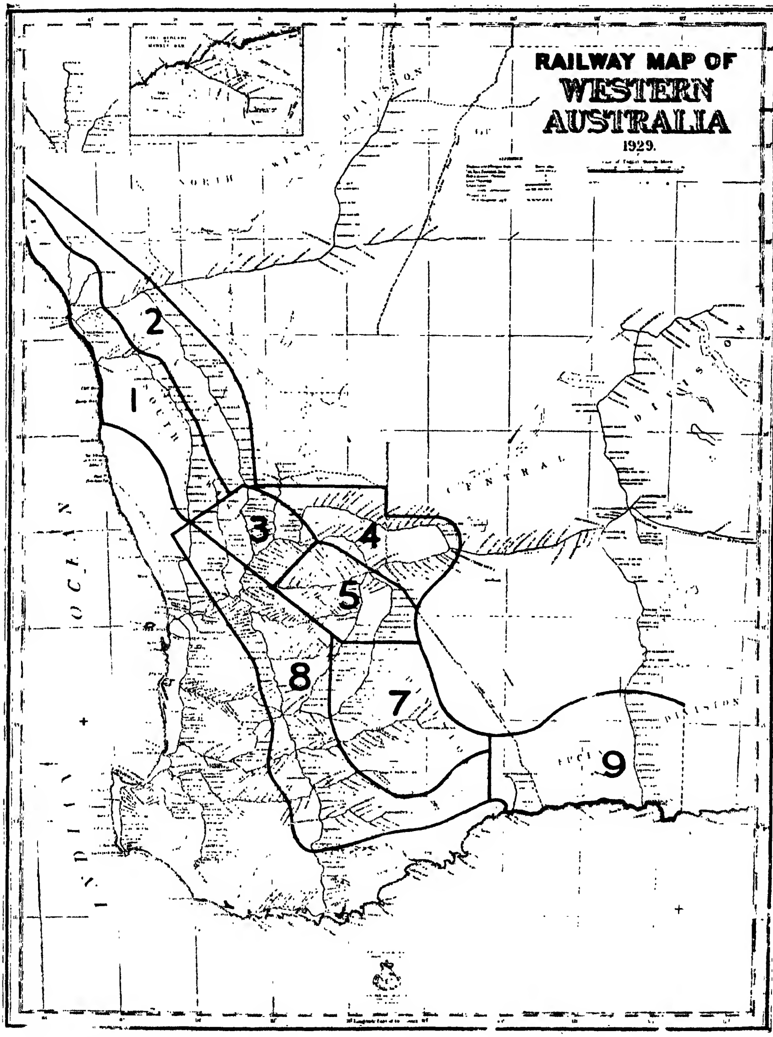
The conditions of the competitions require that the crop shall be grown on fallowed land, shall not be less than 50 acres in area, of one variety, and shall be judged according to the scale of points set out below.

The practice in past competitions has been to allow one point for each calculated bushel of yield. It was realised, however, that this practice could not be continued without the scale of points being modified. It was decided, therefore, to make alterations in the scale of points under which the competition was judged to enable the present practice to be continued. The alterations made are as hereunder:—

	Old Scale.	New Scale.
Yield	40	50
Freedom from weeds	20	10
Freedom from disease	15	10
Freedom from admixture	15	15
Evenness of growth	10	15
	100	100

The points awarded for yield are not based upon the estimated yield, but upon that calculated from portions of the crop obtained from small areas taken systematically throughout the crop. These portions of the crop are threshed and the grain weighed.

The judges of the Royal Crop Competitions since their inception have been departmental officers attached to the Wheat Branch, and the same officers have also judged the majority of the district competitions. As it is



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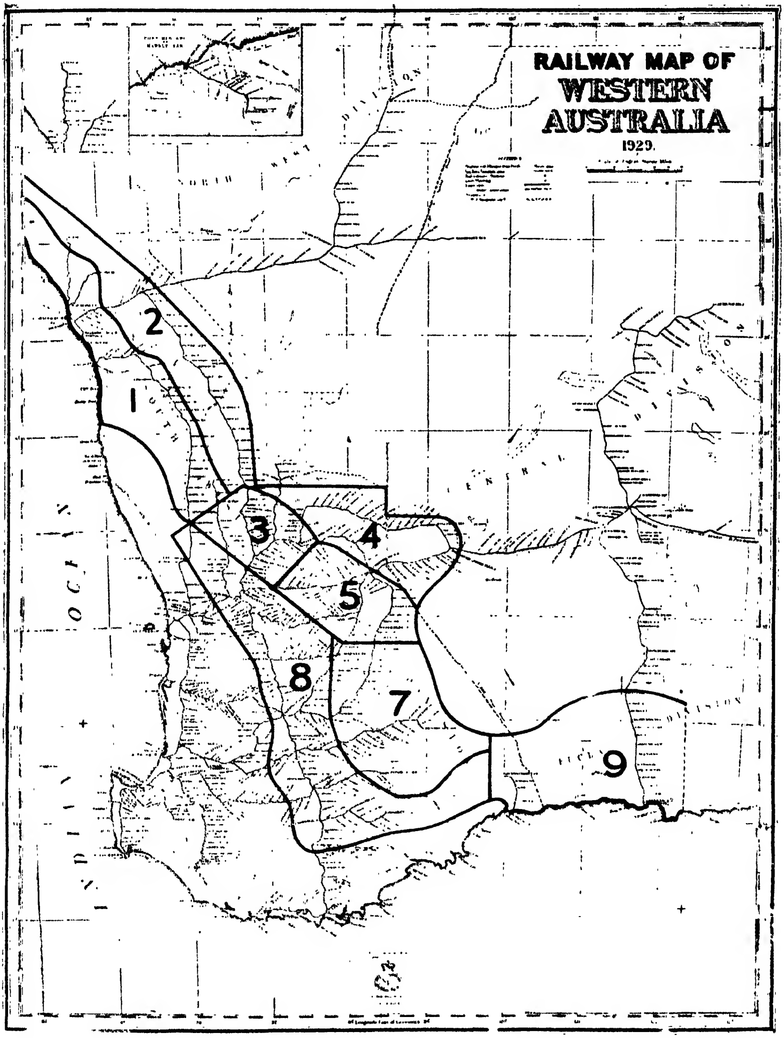

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so that the Societies which are adjacent to each other and which have similar interests and climatic conditions are grouped together. The competitors were located at centres extending from Indarra in the North to Esperance and Ravensthorpe in the South, and in order to complete the judging in the limited time available, six officers of the Wheat Branch were engaged on the work.

ZONE 1.

Judge—F. L. SHIER, B.Sc.(Agric.), Agricultural Adviser.

In this zone seven entries were received directly through the Royal Agricultural Society, all of which were in the Carnamah district. The general lack of interest in these competitions in this zone, one of the finest wheat-producing districts in the State, is very hard to understand.

The points awarded to the various competitors are shown in the table hereunder:—

ROYAL AGRICULTURAL SOCIETY.
ZONE 1.
Judge—F. L. SHIER, S.Sc. (Agric.), Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 points.
Lucas, F. ...	Carnamah ...	Nabawa ...	27	9	9	14	13	72
Forrester, J. K.	Carnamah ...	Bena ...	26	9	9	14	13	71
Robertson, R.	Carnamah ...	Merredin ...	25	8	9	14	13	69
Bowman, J. ...	Carnamah ...	Merredin ...	26	8	7	14	13	68
Johnson, I. ...	Winchester ...	Nabawa ...	24	8	9	14	13	68
Cuming Bros. ...	Carnamah ...	Nabawa ...	23	8	8	13	13	65
Green Bros. ...	Carnamah ...	Merredin ...	22	8	8	14	13	65

Generally speaking the crops were not up to their usual high standard, the average of the seven competitors being just under 25 bushels, being due, no doubt, to the very light rains in August, September and October.

Below is given the rainfall for 1929:—

——	Jan.	Feb.	Mar.	Apl.	Useful rains. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
Carnamah	26	113	22	8	352	424	214	121	35	24	1,171	118	...	1,458

The winning crop of Mr. F. Lucas, Inering, Carnamah, was of the Nabawah variety and was calculated to yield 27 bushels per acre. It was well stooled and headed and of a nice even height. Very few weeds and admixture were present. Except for an odd small patch of Takeall, it was very free from disease.

The entry gaining second prize was Mr. J. K. Forrester's crop of Bena, and was calculated to yield 26 bushels per acre. Early in the season this crop gave promise of being an exceptionally high yielding one, but owing to the light spring rainfall the crop suffered considerably, the heads not filling out well, and in some places being tipped.

It had stooled very heavily, and was very free from weeds or foreign heads. No disease was noticed.

A table showing details of the cultural methods employed by the various competitors appears on the next page.

CULTURAL DETAILS.

Competitor.	No. of years cropped.	Land and Timber.	When fallowed.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Treated.	Graded.	Disease.
hnson, Ivan ...	3 years. 1 fallow	Heavy loam. Salmon Gum	June, 1928	Disc.	ins. 3½–4	Cross disced August, springtyne cultivated October and again Dec. Planted with combined cultivator-drill	Nabawa	Mid May ...	45	120	Dry	Re-cleaned	
ming, A. ...	8	Salmon and Gimlet	July	Disc.	ins. 3½–4	Twice springtyne cultivated and planted with combined cultivator-drill	Nabawa	1st week May	55–60	112	Dry	Yes	Trace, Ball Smut.
een Bros. ...	Cleared abt. 16 years, cropped 6 times	Heavy red loam, York Gum	July, 1928	Disc	ins. 3	Drilled with combined cultivator-drill	Merredin	3rd week May	50	100	No	No	Traces, Ball Smut, Flying Smut, and Takeall
cas, F. ...	4	Quartzy clay, Salmon, Gimlet and York Gum	June, July	Part mouldboard, part disc	ins. 4	Ploughed back Aug. springtyne cultivated Sept. Planted with a combined cultivator-drill	Nabawa	1st week May	50	112	Dry	Yes	Trace, Takeall.
rrester, J. K.	New land	Heavy red loam, York Gum	July, 1928	Disc	ins. 4	Springtyne cultivated end Sept. Planted with combined cultivator-drill	Bena	1st week May	48	93	Dry	Yes	
bertson, R. ...	6th or 7th crop Cleared 13 years	Heavy loam, Salmon, Gimlet and York Gum	August	Half disc, half mouldboard	ins. 4	Tandem disc cultivated September. Sundercut May. Planted with combined cultivator-drill	Merredin	Last week May	45–50	90	Dry	Yes	
wman, J. ...	6–8 crops	York Gum and Teatree	August	Disc	ins. 4	Twice disced spring, springtyne cultivated and harrowed before seeding	Merredin	Mid May ...	60	100	Dry	Yes	Traces, Takeall and Ball Smut

ZONE 2.

Judge—F. L. SHIER, B.Sc.(Agric.). Agricultural Adviser.

Entries for this zone were received through the Dalwallinu Agricultural Society, while one competitor, Mr. T. Moore, Indarra, entered directly with the Royal Agricultural Society.

DALWALLINU AGRICULTURAL SOCIETY.

A very gratifying feature this year was that of the 16 entries received by the Society, 14 remained for the judge's inspection. They comprised crops in Dalwallinu, Pithara, Ballidu and Xantippe on the Rabbit-proof Fence about 25 miles East of Dalwallinu. Generally speaking the crops throughout these districts were much better than in 1928, due no doubt to the better rainfall in 1929.

Dalwallinu Rainfall.

——	Jan.	Feb.	Mar.	Apl.	Useful rains. May	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
1928 ...	49	...	13	42	136	128	307	168	93	48	880	...	74	1,056
1929 ...	20	165	29	3	403	330	164	82	15	123	1,117	78	3	1.415

Excellent May and June rains were recorded, whilst that in July (162 points) following the previous two months, was sufficient, but the falls decreased towards the end of the growing period, September (15 points) and October (23 points) being particularly light. Despite this, the average yield of all competitors was 22 bushels, which is indeed very creditable. Had good falls been experienced in September and October a record harvest undoubtedly would have resulted.

Sheep are becoming more in evidence in these districts and the benefit to be derived from them will soon be felt, especially on the weedy morrell soils.

The most popular variety in this district is Gluyas Early because of its drought resistance and earliness, whereby good crops are obtained under very light rainfall. This variety is very subject, however, to Flag Smut, and this disease was noticed in every crop of Gluyas Early examined. The methods of controlling this disease are dealt with later.

The points awarded to the various competitors are shown in the table hereunder:—

DALWALLINU AGRICULTURAL SOCIETY.

ZONE 2.

Judge—F. L. SHIER, B.Sc. (Agric.), Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 points.
Bradford Bros....	Ballidu ...	Gluyas Early	29	9	9	14	13	74
Beilby, A. H. ...	Ballidu ...	Gluyas Early	26	9	9	14	14	72
Locke, F. C. ...	Dalwallinu ...	Merredin ...	25	9	8	13	14	69
Homer & Sons	Dalwallinu ...	Gluyas Early	24	9	9	13	13	68
Locke, J. ...	Pithara ...	Merredin ...	23	8	8	14	14	67
Locke, H. ...	Pithara ...	Golden King	25	8	7	13	13	66
Anderson, H. W.	Pithara ...	Merredin ...	22	9	7	13	14	65
Sawyer, W. H.	Xantippe ...	Nabawa ...	19	9	9	14	14	65
Sutherland Bros.	Pithara ...	Nabawa ...	21	8	8	13	14	64
McNeill, C. ...	Dalwallinu ...	Gluyas Early	20	9	8	14	13	64
Wilson & Son ...	Dalwallinu ...	Gluyas Early	20	9	8	14	13	64
Sawyer, J. H. ...	Dalwallinu ..	Nabawa ...	22	7	8	13	13	63
Bussell, D. ...	Xantippe ...	Merredin ...	18	9	8	14	14	63
Hinkley & Sons	Xantippe ..	Nabawa ...	16	9	9	14	13	61

The winning crop of Messrs. Bradford Bros. was of the Gluyas Early variety and was calculated to yield 29 bushels per acre. It had stooled well, was of a nice stripping height and well headed. Except for an odd mustard, it was free from weeds, but a trace of the disease Flag Smut was present.

The crop gaining second prize, of Mr. A. H. Beilby, was also Gluyas Early and was calculated to yield 26 bushels per acre. It was very even, free from weeds and strange heads, but a trace of Flag Smut was noticed.

The cultural methods as employed by the various competitors are shown in the following table:—

CULTURAL DETAILS.

Competitor.	No. years cropped.	Land and Timber.	When fallowed.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Treated.	Graded.	Disease.
Bradford Bros.	6, 3 fallows	Salmon, Gimlet and Morrel	June–July	Disc	ins. 4	Springtyne cultivated Sept., and again during summer. Planted with combined cultivator-drill	Gluyas Early	Mid May ...	55	90	Dry	Re-cleaned	Odd trace Flag Smut.
Beilby, A. H. ...	5	Red loam. Salmon, Gimlet, and Morrel	July	Disc	4–6	Springtyne cultivated four times during spring and early summer, and again before drilling	Gluyas Early	Mid May ...	50	112	Dry	Re-cleaned	Odd Flag Smut.
Locke, F. C. ...	7	Salmon, Gimlet and Morrel	July	Mould-board	3½–4	Springtyne cultivated Sept. Harrowed Dec., and springtyned prior to drilling	Merredin	Mid May ...	55	90	Dry	Yes	Ball Smut and Takeall
Honner & Sons	5 crops, 2 fallows, 1 pasture year	Salmon and Gimlet	Early July	Mould-board	4	Cross disced Sept., twice springtyne cultivated and three harrowings spring and early summer. Springtyne cultivated in front of drill.	Gluyas Early	Mid May ...	45	112	Dry	Yes	...
Locke, J. ...	5 crops	Salmon and Gimlet	Sept.	Disc	3½	Half cultivated prior to seeding. Planted with combined cultivator-drill	Merredin	End April ...	53	60	Dry	Cleaned	Trace Take-all and Ball Smut
Locke, Alan ...	4 crops, 1 fallow	Heavy red clay. Salmon, Gimlet mainly: trace Morrel	June	Mould-board	4	Springtyne cultivated three times during spring, and harrowed twice summer. Planted with combined cultivator-drill	Golden King	1st week May	48	80	Dry	Yes	Ball Smut and Flag Smut.

CULTURAL DETAILS—*continued.*

Competitor.	No. years cropped.	Land and Timber.	When fallowed.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Treated.	Graded.	Disease.
					ins.								
Anderson, H. W.	7 crops, 3 fallows	Medium red loam. Gimlet and Scrub	July	Disc	3½	Springtyne cultivated, then harrowed during spring. Cultivated before drilling	Merredin	2nd week May	50	75–80	Dry	Yes	Flag Smut and trace Takeall and loose Smut.
Sawyer, W. H.	2	Morrel, Gimlet and Teatree	June-July	Disc	3½	...	Nabawa	End April ...	50	60	Dry	Re-cleaned	Trace Ball Smut and Takeall.
Sutherland Bros.	Unknown	Quartz, red loam. Giant Teatree, Gimlet and Morrel	August	Disc	3½–4	Springtyne cultivated Sept. Harrowed October and February. Cultivated in front of drill	Nabawa	Mid May ...	50	100	Dry	Re-cleaned	Trace Ball Smut and Takeall.
McNeill, C. H. ...	About 10 pasture fallow crop last 3 years	Salmon and Morrel	July	Mould-board	4	Disced September	Gluyas Early	Mid April ...	50	50	Dry	Yes	Trace Flag Smut.
Wilson, H. E. & Son	3rd crop 2nd fallow	Medium red loam Salmon and Morrel	July	Mould-board	4	Springtyne cultivated twice during spring. Harrowed summer. Planted with combined cultivator-drill	Gluyas Early	2nd week May	50	70	Dry	Yes	Trace Ball Smut and Flag Smut.
Sawyer, J. H. ...	Since 1916 fallow wheat rotation	Salmon, Gimlet and York Gum	August	Mould-board	3½–4	Springtyne cultivated in September and before drilling	Nabawa	Last week April	60	80	Dry	Re-cleaned	Ball Smut and Takeall.
Bussell, D. ...	1	Gimlet and Teatree	July	Disc	3½	...	Merredin	Mid April ...	55	60	...	Cleaned	Trace Ball Smut.
Hinkley & Sons	2	Gimlet, Teatree, Scrub	June	Disc	3½	Cultivated before seeding. Planted with combined cultivator-drill	Nabawa	June	50	75	Dry	Re-cleaned.	...

ROYAL AGRICULTURAL SOCIETY.

The only entry received direct by the Royal Agricultural Society was that of Mr. T. Moore, Indarra. The award is as follows:—

ROYAL AGRICULTURAL SOCIETY,

ZONE 2.

Judge—F. L. SHIER, B.Sc. (Agric.), Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
Moore, T. ...	Indarra ...	Nabawa ...	27	9	9	14	14	73

This award of 73 points places Mr. T. Moore second for the Royal Agricultural Society zone prize. His crop of Nabawa was an exceedingly fine one and was calculated to yield 27 bushels per acre. It was very even, had stooled well and had well filled heads. No disease was present and it was very free from weeds and foreign heads. The crop was sown on medium red loam, originally carrying York Gum timber, at the end of April with a combined cultivator drill, sowing 60 lbs. of ungraded, dry pickled seed and 90 lbs. of super. The land was disc ploughed in June, 1928, 4 inches deep, harrowed in July and springtyne cultivated in December and again in February.

ZONE 3.

Judge—A. S. WILD, B.Sc. (Agric.), Agricultural Adviser.

Four district Agricultural Societies conducted crop competitions in this Zone. The competitors in two, viz., Dowerin and Wongan Hills, were eligible for competition for the Zone championship prizes. However, entries were received by the Royal Agricultural Society from the Goomalling and Wyalkatchem Agricultural Societies too late to be accepted.

DOWERIN AGRICULTURAL SOCIETY.

Of the thirteen entrants in the competition of the above Society, eleven submitted crops for inspection, the awards being as follow:—

DOWERIN DISTRICT AGRICULTURAL SOCIETY.

ZONE 3.

Judge—A. S. WILD, B.Sc. (Agric.), Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 points.
G. J. Williams ...	Hindmarsh ...	Gluyas Early	26	8	8	13	14	69
E. C. Cosh ...	Minnivale ...	Nabawa ...	24	9	9	13	13	68
Hughes, J. ...	Minnivale ...	Nabawa ..	24	8	9	14	12	67
Anderson, J. S.	Dowerin ...	Pusa ...	23	8	9	12	14	66
Jones, J. S. ...	Ejanding ...	Gluyas Early	23	8	8	14	12	65
Jones, A. ...	Ejanding ...	Nabawa ...	22	8	8	14	12	64
Don, G. ...	Hindmarsh ...	Nabawa ...	22	7	8	13	13	63
Bear, H. E. ...	Minnivale ...	Gluyas Early	20	8	8	14	12	62
O'Loughlan, M.	Minnivale ...	Gluyas Early	20	8	8	13	12	61
Thomas, T. ...	Dowerin ...	Nabawa ...	18	8	9	14	12	61
McKinnon, W.	Dowerin ...	Gluyas Early	18	7	8	12	13	58

The crop of Mr. G. J. Williams was awarded first place with a total of 69 points, the calculated yield being 26 bushels per acre. This crop had been planted on land ploughed during early July of the previous year. At the end of August the fallow had been springtyne cultivated and harrowed early in September. It was further springtyne cultivated after rain in March. The crop was planted with a combined cultivator-drill with light drag harrows attached. This operation took place during the third week in May, 45 lbs. of seed and 75 lbs. of superphosphate being applied.

The rainfalls as recorded at the various centres in the district during the year were as follow:—

—	Jan.	Feb.	Mar.	Apl.	Useful Rains. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
Dowerin	17	175	81	...	335	418	192	104	34	42	1,125	71	3	1,472
Ejanding	28	233	42	...	280	348	114	122	12	44	920	102	2	1,327
Minnivale	19	165	47	...	299	366	196	112	28	7	1,011	100	3	1,345

The cultural methods of the various competitors are summarised as follows:—

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
Williams, G. J....	Old land ...	Salmon and gimlet	Early July	Good ...	Disc ...	ins. 3½–4	Springtyne cultivated end of August; harrowed early September. Springtyne cultivated in March after rain. Drilled with combined cultivator-drill with light harrows attached	Gluyas Early	15th to 20th May	45	75	Dry	No	Traces Flag Smut and Ball Smut.
'osh, E. C. ...	1	Salmon, Gimlet and Teatree scrub	July	Good ...	Disc ...	3	Springtyne cultivated in September, again in October and again before seeding	Nabawa	1st May week	45	100	Dry	Recleaned	
Hughes, J. ...	Old land ...	Gimlet and Mallee	August	Hard in places	Mould-board and disc	4	Disced 2in. deep in September. Springtyne cultivated in February after rain. Scarified immediately prior to seeding. Drilled with combined cultivator drill, with light drag harrows attached	Nabawa	2nd week May	45	100	Dry	Yes	
Anderson, J. S.	Old land ...	Morrel running to Salmon Gum and Gimlet	August	Dry ...	Mould-board	3½–4	Harrowed twice in spring. Springtyne cultivated in May. Drilled with combined cultivator-drill. Harrowed twice just after seeding	Pusa	2nd week June	60	90	Dry	Yes	

CULTURAL DETAILS—*continued.*

Competitor.	No. years cropped.	Timber	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
Jones, J. S. ...	About 8 ...	Chiefly Morrel	July	Good ...	Mouldboard	ins. 2½	Springtyne cultivated twice in September and again in March after rain. Drilled with combined cultivator-drill and harrowed immediately after	Gluyas Early	1st week June	60	90	No—Stud plot dry pickled	Yes	Flag Smut.
Jones, A. ...	Old land ...	Chiefly gimlet	July	Good ...	Disc ...	3½	Springtyne cultivated in September and August, and again twice before seed-Drilled with combined cultivator-drill	Nabawa	Mid May ...	50	120	Portion dry pickled	Yes	Traces Ball Smut and Takeall.
Don, G. ...	3	Gimlet and Salmon	August	Getting hard	Disc ...	3½	Harrowed in September. Drilled with combined cultivator-drill	Nabawa	16th May ...	60	90	Bluestone	Recleaned	Trace Takeall.
Bear, H. E. ...	Old land	Gimlet, Salmon and Morrel	June	Fair ...	Disc ...	3½	Springtyne cultivated in September. Harrowed in February after rain and scarified before seeding	Gluyas Early	3rd week May	50	90	Dry	Recleaned	Flag Smut and trace Takeall.
O'Loughlan, M.	About 15...	Salmon and Gimlet	July	Good ...	Mouldboard	4	In June, 1928 the land was ploughed indifferently with a disc plough. Bedisced 2in. deep in October and again before seeding. Drilled with combined cultivator-drill	Gluyas Early	Last week May	60	100	Dry	Yes	Trace Flag Smut.

CULTURAL DETAILS—*continued.*

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
						ins.								
Thomas, T. ...	1st since abandoned some years previously	Mallee and Teatree	July and August	Good ...	Disc ...	2½	Redisced 1½in. deep prior to seeding	Nabawa	1st week May	37	90	Dry	Yes	
McKinnon, W.	Old land...	Gimlet and Salmon	August	Hard in places	Mould-board	4	Harrowed in September, disced 2in. deep in February after rain. Drilled with combined cultivator-drill and harrowed immediately after	Gluyas Early	25th April ...	45	60	No	No	Traces Ball smut and Flag smut.

WONGAN HILLS AGRICULTURAL SOCIETY.

Eleven competitors in the Wongan Hills Agricultural Society's crop competition submitted crops for inspection. The following table shows the awards made:—

WONGAN HILLS AGRICULTURAL SOCIETY.

ZONE 3.

Judge: A. S. Wild, B.Sc. (Agric.), Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
W. N. Armstrong	Wongan Hills	Nabawa ...	30	9	9	13	14	75
G. F. Fowler ...	Wongan Hills	Clubhead ...	31	8	9	13	13	74
Mt. Rupert Co.	Wongan Hills	Gresley ...	30	8	8	13	13	72
A. E. Parker ...	Wongan Hills	Nabawa ...	28	8	9	13	13	71
J. Mincherton ...	Kokardine ...	Nabawa ...	23	9	9	14	14	69
J. H. Ackland ...	Wongan Hills	Nabawa ...	25	9	8	14	12	68
Smith & Nunn...	Wongan Hills	Nabawa ...	27	7	9	13	12	68
P. Martin ...	Wongan Hills	Bena ...	22	9	9	14	13	67
C. H. Park ...	Wongan Hills	Gresley ...	21	8	9	12	14	64
R. R. Ackland...	Wongan Hills	Ford ...	20	9	9	13	12	63
P. W. Gorman...	Rock Hill ...	Ford ...	19	9	9	13	13	63

The winning crop was of the variety Nabawa and had been planted during the first week in May at the rate of 60 lbs. of seed and 100 lbs. of superphosphate per acre. It was very even, well headed and well stooled, free of disease and, except for a few wild oats, comparatively free of weeds. The land had been June fallowed and during September had been redisced four inches deep, the full depth of the original ploughing. Subsequently it was twice springtyne cultivated in the spring and twice again prior to seeding.

Mr. G. F. Fowler's crop of the variety Clubhead, although calculated to yield a bushel per acre more than the winning crop, lost points owing to weeds and uneven growth.

The Mt. Rupert Company's crop of Gresley was calculated to yield 30 bushels per acre, as was the winning crop, but this also lost points awarded under the other sections and was consequently awarded third place.

The rainfall as recorded at Wongan Hills during the year was as follows:

Wongan Hills.

Jan.	Feb.	Mar.	Apl.	Useful Rains.							Nov.	Dec.	Total for year.
				May.	June.	July.	Aug.	Sept.	Oct.	Total.			
21	178	84	...	339	534	236	145	11	177	1,442	51	...	1,776

Methods of cultivation adopted by the competitors are shown on pages 24-25.

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted,	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
						in.								
Armstrong, W. N.	Old land	Salmon and Gimlet	June	Good	Disc.	4	Re-disced 4in. deep in Sept. Springtyne cultivated tw ce in spring and twice before seeding.	Nabawa	1st week May...	60	100	Dry	No	
Fowler, G. F. ...	Old land	Salmon and Gimlet running to Mallee	Aug.	...	Disc.	4	Redisced 2in. deep in Sept. Springtyne cultivated in January	Clubhead	End of May ...	50	90	Dry	\	ice, Take-l.
Mt. Rupert Co.	About 6	Salmon and Morrel	July	Good	Disc.	4	Harrowed end of July; springtyne cultivated in Aug.; harrowed in Sept. Springtyned cultivated in March, drilled with combine cultivator-drill. Harrowed after seeding.	Gresley	2nd week May	60	112	Dry		aces, Ta... ll. Bal... mut, an... lying Sm...
Parker, A. E. ...	Old land	Salmon, Morrel and Gimlet	June and July	Good	Disc.	3	Springtyne cultivated in October; harrowed in Jan. after rain. Springtyne cultivated in February and again in March after rain. Drilled with combined cultivator-drill	Nabawa	3rd week May	60	110 24 per cent.	Dry		
Mincherton, J....	1	Tussocky & Mallee sandplain	End July	Good	Disc.	4	Re-disced 2in. deep in March.	Nabawa	2nd week April	50	120	Dry	Yes	

CULTURAL DETAILS—*continued.*

Competitor.	No. years cropped.	Timber	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
Ackland, J. H.	4	Salmon running to York Gum	July	Good	Disc.	ins. 3½	Re-disced 2in. deep in Sept., and harrowed in October. Springtyned cultivated in April and drilled with combined cultivator-drill with light harrows attached	Nabawa	1st fortnight, May	55	120	Dry	Yes	Traces, Take-all and Flag Smut, probably in admixture.
Smith and Nunn	10	Salmon, Gimlet and Morrel	July	Fair	Mouldboard	2½	Disc cultivated in Sept. Springtyne cultivated in Oct., and again in April	Nabawa	End of April ...	45	90	Dry	Yes	
Martin, P ...	1	Smokebush plain	July	Good	Disc	3	Re-disced 2½ins. deep in March	Bena	Last week, Apl.	45	112	Dry	Yes	
Park, C. H. ...	2	Tussocky scrub plain	June	Good	Disc	4	Re-disced 2½ins. deep in Sept., and drilled with combined cultivator-drill	Gresley	End of May ...	45	90	Dry	Yes	Trace, Flying Smut.
Ackland, R. R.	...	...	...	...	...	...	... ...	Ford	...	...	...	...	...	
Gorman, P. W.	2	Tamma and Smokebush plain	Aug.	Good	Mouldboard	4	Harrowed immediately prior to seeding	Ford	2nd week May	60	112	Dry	Yes	

GOOMALLING AGRICULTURAL SOCIETY.

In connection with the crop competition conducted by this Society, three crops only were inspected. Of these, two were those of Mr. H. H. Carter, of Konongorring, and he secured first and second places with the varieties Dollar and Ford respectively.

The following table shows the details of the awards:—

GOOMALLING DISTRICT AGRICULTURAL SOCIETY.

ZONE 3.

Judge: A. S. Wild, B.Sc. (Agric.), Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
H. H. Carter ...	Konongorring	Dollar ...	39	7	9	13	13	81
H. H. Carter ...	Konongorring	Ford ...	31	8	9	13	14	75
J. F. Miller ...	Oak Park ...	Nabawa ...	26	7	9	13	13	68

The winning crop was an exceptionally fine one and was calculated to yield 39 bushels per acre. Points were lost for weeds, chiefly wild oats and canary grass. Odd barley plants were noticed and also a trace of the disease "Takeall." The land had been fallowed in July and August, disc cultivated to a depth of two inches during the month of October and again in April. The crop had been planted with a combined cultivator-drill during the second week in May at the rate of 60 lbs. of seed and 90 lbs. of superphosphate per acre.

The rainfalls as recorded at Konongorring and Goomalling throughout the year are shown hereunder:—

—	Jan.	Feb.	Mar.	Apl.	Useful Rains.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Konongorring	28	170	185	10	324	508	290	139	35	147	1,443	114	4	1,954
Goomalling	21	78	128	7	224	419	239	130	44	109	1,163	294	8	1,601

The following table summarises the cultural methods of the competitors.

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
						ins.								
Carter, H. H. ...	Old land ...	Salmon and Gimlet	July and August	Getting hard	Mould-board	4	Disced 2ins. deep in October, and again in April Drilled with combined cultivator-drill	Dollar	2nd week May	60	90	Dry	Yes	Trace, Take-all.
Carter, H. H. ...	4	Salmon and Gimlet	July and August	Getting hard	Mould-board	4	Springtyned cultivated twice in October. Portion ploughed back 2in. deep with mould-board during Mar. Drilled with combined cultivator-drill.	Ford	1st May ...	60	90	Dry	Yes	Trace, Take-all.
Miller, J. F. ...	Old land ...	Chiefly Salmon Gum	July	Good	Mould-board	3	Harrowed early September; springtyne cultivated end of September and again in March. Drilled with combined cultivator-drill	Nabawa	2nd week May	55	95 24 per cent.	Dry	Yes	Small patches Takeall.

WYALKATCHEM AGRICULTURAL SOCIETY.

Ten crops were inspected in connection with the competition conducted by the above Society, awards being made as follow:—

WYALKATCHEM DISTRICT AGRICULTURAL SOCIETY.

ZONE 3.

Judge: A. S. Wild, B.Sc. (Agric.), Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 points.
W. W. Jones ...	Cowcowing ...	Nabawa ...	36	9	9	13	14	71
W. H. Grace ...	North Korrelocking	Merredin ...	24	8	8	14	15	69
A. Allen ...	South Korrelocking	Nabawa ...	24	9	8	14	13	68
C. E. Lehmann	Cowcowing ...	Gluyas Early	24	8	8	13	14	67
S. W. Robinson	Cowcowing ...	Merredin ...	24	9	7	13	13	66
G. Threlfall ...	Korrelocking	Merredin ...	23	8	8	14	13	66
R. Gamble ...	...	Toby's Tusk	24	8	7	13	13	65
C. P. Fenwick ...	Nalkain ...	Nabawa ...	18	9	9	14	12	62
J. E. Tylor ...	Korrelocking	Nabawa ...	18	8	9	14	12	61
J. B. Locyker ...	Cowcowing ...	Gluyas Early	21	8	6	13	12	60

Mr. W. W. Jones secured first place with the variety Nabawa, calculated to yield 26 bushels per acre. The crop was even in growth, free of weeds and comparatively free of disease, but lost points owing to admixture. It had been planted at the end of April with 45 lbs. of seed per acre. Five competitors in this competition secured calculated yields of 24 bushels per acre. Flag Smut was noticed in several crops and, in spite of the seed being treated for the prevention of Ball Smut, this disease also was present in several.

The rainfalls as recorded at the various centres in the district are as follow:—

—	Jan.	Feb.	Mar.	Apl.	Useful Rains.						Total.	Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.				
Cowcowing	13	183	71	....	366	299	125	120	8	51	969	147	2	1,385
Korrelocking	16	166	66	...	363	336	131	105	22	105	1,062	121	...	1,431
Wyalkatchem	9	154	62	6	297	374	155	107	19	82	1,034	110	5	1,380

The methods of cultivation are summarised on the following page.

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
Jones, W. W. ...	2	Salmon, Gimlet, and some Morrell	July	Good	Disc.	Ins. 3½	Springtyne cultivated in September and harrowed after rain. Drilled with combined cultivator-drill	Nabawa	4th week April	45	60	Dry	Yes	Trace, Flag Smut, probably in admixture.
Grace, W. H. ...	About 13	Salmon and Gimlet	Early July	Good	Disc.	4	Springtyne cultivated before seeding	Merredin	1st week May	45	70	Dry	Yes	Traces Flying Smut and Flag Smut
Allan, A. ...	3	Salmon and Gimlet	July	Good	Disc	3	Disced 3in. deep in August; springtyne cultivated in October, and drilled with combined cultivator-drill	Nabawa	1st week May	45	50	Dry	Yes	Traces Ball Smut
Lehmann, C. E.	6	Gimlet and Salmon	July	Good	Mouldboard	4	Springtyned cultivated in Sept. Harrowed 3rd week in Nov., and again in Dec. after rain. Springtyne cultivated in March, and drilled with combined cultivator-drill	Gluyas Early	12th May ...	47	90 24 per cent.	Dry	Yes	Traces Ball Smut, and Takeall.
Robinson, S. W.	...	Salmon and Gimlet running to York Gum	July	Good	Disc	...	Springtyne cultivated in September and again immediately prior to drilling with combined cultivator-drill	Merredin	20th April ...	50	90	Dry	Yes	Flag Smut, traces Ball Smut, and Flying Smut

CULTURAL DETAILS.—*continued*

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
Threlfall, G. ...	Old land about 12	Gimlet and some Salmon	1st wk. June	Good	Mouldboard	ins. 3½	Scarified 1st week in Sept., harrowed early Dec. Springtyne cultivated 4th week in Feb. Harrowed in March and drilled with combined cultivator-drill	Merredin	13th May ...	45	110	Dry	Yes	Flag Smut, trace Take all.
Gamble, R. ...	4	Salmon and Gimlet	July	Good	Disc	4	Springtyne cultivated in September. Drilled with combined cultivator drill with harrows following	Toby's Tusk	2nd week May	45/50	85	Dry	Yes	Flag Smut, traces Flying Smut and Takeall
Fenwick, C. P.	1	Gimlet, Salmon and Teatree	April, 1929	...	Disc	2½ to 3	Drag harrows behind drill.	Nabawa	1st fortnight, May	45	120	Dry	Yes	
Tyler, J. E. ...	About 11	Mixed, Salmon, Gimlet, Jam, and York Gum	June	Good	Mouldboard	4	Springtyne cultivated in Sept. Harrowed twice in spring after rain, disced before seeding, and drilled with combined cultivator-drill	Nabawa	1st week May...	60	125	Dry	Yes	Trace Takeall.
Lockyer, J. B....	5	Salmon and Gimlet; small portion Wodjil.	July	Good	Disc	4	Springtyne cultivated in Sept. Harrowed in Dec. after rain, again in Feb. after rain; drilled with combined cultivator-drill	Gluyas Early	5th to 17th May	45	90	Dry	Recleaned	Flag Smut, some Ball Smut, traces Flying Smut and Takeall

ZONE 4.

The Agricultural Societies conducting crop competitions in this zone were those of Mt. Marshall and Nungarin. In addition the Karloning and Yilgarn Primary Producers Associations respectively conducted local competitions which, although judged according to the same scale of points did not compete in the zone competitions.

MT. MARSHALL AGRICULTURAL SOCIETY.

Judge—R. P. ROBERTS, B.Sc. (Agric.), Agricultural Adviser.

The winning crop in this district competition was of the variety Nabawa submitted by Mr. M. C. Collins. The crop had stooled well and made good growth, although somewhat uneven in places.

Mustard and wild oats were present, and also plants of other varieties of wheat.

The land, which varied from Salmon and Gimlet to York Gum and scrub, was ploughed 4in. deep during the previous July with a mouldboard plough. It was disc harrowed in February and again in March.

Mr. B. W. G. Hopwood's entry, which was placed second, was calculated to yield 18 bushels per acre. The variety was Gluyas Early planted during the second week in May. The crop was even and free from weeds, but contained a little admixture and was infected with the disease Flag Smut.

The land, which had originally carried York Gum, Mallee and scrub, was ploughed 4½in. deep during June and July, with a disc plough. It was cultivated with a springtyne implement in August and September and planted with a combined cultivator-drill.

The rainfalls recorded at Beneubbin and North Beneubbin for the 1929 growing period are as given below:

——	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total May to Oct.
Beneubbin ...	11	84	65	...	302	182	86	100	16	25	711
North Beneubbin...	...	27	52	...	361	210	42	61	22	48	744

The following tables show the points awarded and the cultural methods employed by the competitors:—

MT. MARSHALL AGRICULTURAL SOCIETY.

ZONE 4.

Judge—R. P. ROBERTS, B.Sc. (Agric.), Agricultural Adviser.

Competitor.	District.	Variety.	Yield, 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
Collins, M. C. ...	Beneubbin ...	Nabawa ...	22	8	9	12	12	63
Hopwood, E. W. G.	Beneubbin ...	Gluyas Early	18	9	8	13	13	61
McManus, E. ...	N. Beneubbin	Gluyas Early	14	9	9	11	13	56
McManus, T. and S.	N. Beneubbin	Gluyas Early	12	7	9	13	11	52

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
						in.								
Collins, M. C. ...	Old land...	Salmon, Gimlet, and some York Gum	End July	Good	Mouldboard	4	Disc harrowed in February and again in March	Nabawa	End of April	50	60	Dry	Yes	Traces of Takeall.
Hopwood, B. W. G.	4	York Gum, Mallee and Scrub	June-July	Good	Disc	4½	Cultivated with a springtyne implement August-September. Planted with a combined cultivator-drill	Gluyas Early	9th to 12th May	45	112	Dry	Yes	Flag Smut.
McManus, E. ...	4	Wodgil, Mallee and Scrub	Feb., 1927	Dry	Disc	4	Disced to a depth of 3in. in August. Planted with a combined cultivator-drill	Gluyas Early	30th May to 3rd June	25	95	Dry	Yes	Little Bunt.
McManus, T. S., and H. E.	4	Salmon, Gimlet and little Morrel	July	Fairly wet	Disc	3½	Springtyne cultivated in September. Harrowed prior to seeding	Early Gluyas	20th May ...	39	85	Dry	Yes	Traces of Bunt.

NUNGARIN-EASTERN DISTRICTS AGRICULTURAL SOCIETY.

Judge—R. P. ROBERTS, B.Sc. (Agric.), Agricultural Adviser.

Nineteen entries were received in this competition, but ten were withdrawn prior to judging.

The season has again been unfavourable for farmers generally. Heavy rains in May and June gave the crops an excellent start, but an exceptionally dry spring did not enable them to fulfil their early promise. However, it was pleasing to note how well most of the crops had withstood the dry conditions experienced during the later stages of growth. The rainfalls recorded at the various centres in the district are as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.						Total May to Oct.
					May.	June.	July.	Aug.	Sept.	Oct.	
Goomarin ...	14	129	84	...	399	269	70	68	14	72	892
Koroloo	5	172	98	7	291	317	112	97	21	59	897
Kwelkan ...	5	109	80	8	299	240	105	71	15	65	795
Mangowine ...	13	123	86	..	429	181	78	70	11	61	830
Mukinbudin ...	7	43	88	...	261	176	63	54	24	82	660

Mr. R. Fitzpatrick's winning plot was a crop of Gluyas Early calculated to yield 25 bushels per acre. The soil was a mixture of Salmon and Morrel country with a little Gimlet and Jam.

The land was ploughed to a depth of four inches at the end of June, 1928. It received a cultivation with a springtyne implement in September and was rolled with a T-bar roller and harrowed in October. It was again harrowed after rain in February. Seeding took place on the 10th May with 43 lbs. of graded seed and 78 lbs. of superphosphate per acre.

This was a dense, well grown crop. In common with all the other crops of Gluyas Early submitted for inspection in this district, there was a certain amount of infection by Flag Smut.

Mr. G. T. Young, of Goomarin, gained second place also with a crop of Gluyas Early sown on the 50 acres of fallow which won the Nungarin Agricultural Society's fallow competition earlier in the year. It was sown at the rate of 45 lbs. of seed and 95 lbs. of superphosphate per acre.

The land, which was Salmon and Gimlet country, was ploughed to a depth of 4in. during the previous June with a mouldboard plough. It was disced (Sundercut) in August, scarified (with harrows behind) in September, and later in the same month it was springtyne cultivated, with harrows behind. It received a further harrowing after the mid-February rains, whilst in March it was harrowed and cultivated with the springtyne cultivator. It received a final working with the springtyne immediately before seeding.

This was a fairly even crop except in isolated patches where water logging had occurred. It was very free from admixture, but contained a fair amount of Flag Smut infection and also a few wild oats.

The following table shows the points awarded and the cultural methods employed by the competitors:—

NUNGARIN-EASTERN DISTRICTS AGRICULTURAL SOCIETY.

ZONE 4.

Judge: B. P. Roberts, B.Sc. (Agric.), Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
Fitzpatrick, R. C.	Nungarin ...	Gluyas Early	25	9	8	14	13	69
Young, G. T. ...	Goomarin ...	Gluyas Early	22	8	8	14	13	65
Reynolds, A. G.	Mukinbudin	Gluyas Early	20	8	8	14	14	64
Williams, F. A.	Talgomine ...	Nabawa ...	19	8	9	14	13	63
Johnson, J. H....	Talgomine ...	Nabawa ...	19	9	9	14	12	63
Creagh, Bros. ...	Kwelkan ...	Nabawa ...	18	9	9	14	11	61
Dumsday, L. ...	Goomarin ...	Nabawa ...	19	7	9	14	11	60
Watson, Bros. ...	Kwelkan ...	Gluyas Early	18	8	6	13	12	57
Dawe, F. J. ...	Nungarin ...	Canberra ...	19	7	7	11	13	57

CULTURAL DETAILS

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
						ins.								
Fitzpatrick, R. C.	4	Salmon Gum, Morrell, and a little Gimlet and Jam	End June	Good	Sunder-cut	4	Springtyne cultivated in September. Rolled with a T-bar roller and harrowed in October. Harrowed after rain in February. Planted with a combined cultivator-drill	Gluyas Early	10th May ...	43	78	Dry	Yes	Flag Smut.
Young, G. T. ...	5	Salmon Gum and Gimlet	Early June	Good	Mould-board	4	Sundercut in August. Scarified (with harrows behind) in September. Springtyne cultivated (with harrows behind) in September. Harrowed in February. Harrowed and springtyne culitvated in March. Springtyne cultivated immediately prior to seeding	Gluyas Early	17th May ...	45	95	Dry	Yes	Flag Smut.
Reynolds, A. G.	3	Salmon Gum and Jam	Early June	Good	Sunder-cut	3/4	Disc. ploughed 3in. deep first week in August. Cultivated with a springtyne implement in September. Harrowed first week in October. Planted with a combined cultivator-drill with harrows attached	Gluyas Early	4th and 6th May	35	90	Dry	Yes	Flag Smut, and a trace of Ball Smut.
Williams, F. A.	About 12	Salmon Gum and Gimlet	Late June	Good	Scarifier and harrows	3	Scarified in August. Scarified and harrowed after rain at the end of March. Planted with a combined cultivator-drill	Nabawa	2nd week May	45	70	Dry	Yes	Traces of Loose Smut.

CULTURAL DETAILS—*continued.*

Competitor.	No. years cropped.	Timber	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations	Variety.	Planted	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
Johnston, J. H.	6	Salmon Gum and Gimlet	June	Good	Disc	ins 4	Cultivated with a springtyne cultivator at the end of August, again in October and again in February	Nabawa	3rd week April	45	80	Dry	Yes	Trace of Loose Smut
Creagh, Bros.	Old land .	Salmon Gum, Gimlet, and Mallee	July	Fairly Good	Disc	3/4	Springtyne cultivated in September and again in February. Harrowed in March Planted with a combined cultivator-drill, followed by harrows	Nabawa	2nd week May	45	90	Dry	Yes	Little loose Smut
Dunsday, L. .	3	Gimlet, Salmon Gum, and a little Mallee	Feb., 1928	Good	Disc	4	Reploughed first week in September Springtyne cultivated in October. Harrowed after rains in February and March. Planted with a combined cultivator-drill	Nabawa	Last week in April	45	90	Dry	Yes	Traces of Loose and Ball Smut.
Watson Bros. . .	Old land ...	Salmon Gum, Morrell, and Tea-Tree	End June	Good	Sunder-cut	3	Harrowed in October and again in March. Planted with a combined cultivator drill	Gluyas Early	3rd week April	45	80	Dry	No	Flag Smut.
Dawe, F. J. ...	Old land ...	Salmon Gum, Gimlet, and Mallee	July	Fairly Good	Disc	3/4	Disced (Sundercut) in September and again prior to seeding	Canberra	1st week May	45/50	90	Dry	Yes	Flag Smut.

KARLONING PRIMARY PRODUCERS' ASSOCIATION.

Judge—R. P. ROBERTS, B.Sc. (Agric.), Agricultural Adviser.

The Karloning Primary Producers' Association is to be congratulated upon its enterprise in promoting a 50-acre crop competition for a cup donated by Mr. John Driver, a farmer resident of the district. It is a progressive step for any district to inaugurate competitions of this nature, but the farmers of Karloning are particularly to be commended for their enthusiasm in the face of difficulties naturally attendant upon an unfavourable season in a new district.

All the crops submitted for inspection were either on new land or first year stubble, and received no cultivation other than that given when being planted with a combined cultivator-drill. Thus, as was only to be expected, there was a noticeable uniformity about the entries and only a relatively small margin separated the best from the poorest crops.

It is hoped that next year a large proportion of the competitors will have their crops on falow. The competition will then serve the purpose for which these competitions were primarily designed, *i.e.*, to emphasise the value of sound farming methods.

Mr. H. Johnson was awarded first place with a crop of Gluyas Early calculated to yield 15 bushels per acre. The land was Salmon Gum, Gimlet and scrub country which had carried its first crop the previous year. Seeding was carried out with a combined cultivator-drill during the second week in May on the previous year's stubble.

Considering the unfavourable season the crop had made good growth, but was somewhat patchy on account of unevenness in the seed bed due to clearing operations. This entry contained a fair amount of admixture of another variety and also some barley. It was almost entirely free from weeds and disease.

In general it was typical of the majority of the entries.

The rainfall recorded at Karloning to October, 1929, is as follows:—

Jan.	Feb.	Mar.	April.	Growing Period.						May to Oct.
				May.	June.	July.	Aug.	Sept.	Oct.	
...	73	117	...	414	191	47	74	38	135	899

The following table shows the points allotted to the competitors:—

KARLONING PRIMARY PRODUCERS' ASSOCIATION.

Zone 4.

Judge: R. P. Roberts, B.Sc. (Agric.), Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
Johnson, H. T.	Karloning ...	Gluyas Early	15	9	9	13	12	58
Tallis, W. ...	Karloning ...	Nabawa ...	13	9	9	13	13	57
Hewitt, E. ...	Karloning ...	Gluyas Early	15	8	8	13	12	56
O'Neil, H. ...	Karloning ...	Nabawa ...	14	9	8	13	12	56
Driver, F. ...	Karloning ...	Gluyas Early	13	9	9	13	12	56
Seaby, H. ...	Karloning ...	Nabawa ...	14	9	8	12	13	56
Bell, O.... ...	Karloning ...	Gluyas Early	11	9	9	14	11	54
Molyneaux Bros.	Karloning ...	Gluyas Early	12	9	8	13	12	54
O'Neil, J. ...	Karloning ...	Gluyas Early	11	9	8	13	12	53
Broomhall, V. ...	Karloning ...	Gluyas Early	12	8	8	12	11	51
Hewitt, B. ...	Karloning ...	Nabawa ...	10	8	9	13	11	51
Watkins, Mrs. O. J.	Karloning ...	Gluyas Early	14	8	7	10	11	50
Howarth & Mitchellmore	Karloning ...	Gluyas Early	11	7	8	12	12	50

YILGARN PRIMARY PRODUCERS' ASSOCIATION.

Judge—G. L. THROSSELL, Dip. Agric., Agricultural Adviser.

The Yilgarn Primary Producers' Association, as was the case last year, promoted two crop competitions, one for crops grown on fallow and the other on non-fallow. For the former six entries were received, and for the latter eight.

The rainfalls recorded at official stations near the competitors were as follow:—

Station.	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	May to Oct.	Jan. to Oct.
Corinthian...	15	86	63	...	336	178	75	61	16	93	759	923
Moorine Rock	40	150	68	1	439	203	71	64	11	56	844	1,103

This area, like many others this season, had splendid early rains, which gave the crops a good start, but when the late rains failed to materialise the yields suffered in consequence. This competition shows, however, that when sound methods are adopted, reasonably good yields can be obtained even in a season when the rainfall is not favourable. The yields obtained from the crops on the unfallowed land in the Moorine Rock district were considerably better than was expected in view of the adverse growing conditions.

50 *Acre Competition on Fallow.*

The competition for 50 acres of wheat of one variety on fallow resulted as follows:—

YILGARN PRIMARY PRODUCERS' ASSOCIATION.

FALLOW.

Judge: G. L. Throssell, Dip. Agric., Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
Dowdall, W. ...	Moorine Rock	Nabawa ...	19	8	9	14	14	64
Pickworth, W. ...	Moorine Rock	Nabawa ...	18	8	9	14	14	63
Davies, R. E. R.	Turkey Hill	Nabawa ...	18	9	9	14	13	63
Swinstead, H. H.	Moorine Rock	Gluyas Early	17	8	8	14	14	61
Lecky, J. V. ...	Corinthian ...	Nabawa ...	16	9	9	13	13	60
Chapman, F. T.	Moorine Rock	Gluyas Early	13	8	9	14	12	56

First place was gained by Mr. H. E. Dowdall of Moorine Rock with a crop of Nabawa, which was awarded 64 points and which was calculated to yield 19 bushels per acre, equivalent to 2¼ bushels per acre per inch of rain in the growing period. The land had been ploughed in June, springtyne cultivated in September, harrowed in January and March and planted with a combined cultivator drill. This crop was fairly true to type, but points were lost for the presence of weeds (Milk Thistles) which are fairly evident also on the fallowed land in this area.

Messrs. W. Pickworth and R. E. R. Davies tied for second with 63 points, the variety in each case being Nabawa. Mr. Davies' yield of 18 bushels was a very creditable one in view of the fact that his crop received 85 points less rain.

It is apparent, after an examination of the cultural methods shown in the following table, that the competitors are applying the knowledge gained from the results obtained at the Yilgarn Experiment Farm. The importance of early fallow, maintaining the mulch during the summer, light seeding, time of planting and varieties cannot be over-stressed in this area. Experiments indicate that the rates of superphosphate could be increased with advantage.

CULTURAL DETAILS—FALLOW SECTION

Competitor.	No. years cropped.	Timber	When fallowed	Implement	Depth.	Subsequent cultivations	Variety	Planted	Rate of Seed	Rate of Super	Pickled	Graded.	Disease
Dowdall, H. E.	2	Morrell, Salmon and Gimlet	June	Disc	ins 4	Springtyned September Harrowed January and March	Nabawa	3rd week April	25	90	Dry	Yes	
Pickworth, W.	3	Morrell, Salmon and Gimlet	July	Scarified	3	Harrowed August Scarified September Harrowed January and March	Nabawa	End April	25	90	Dry	Yes	
Davies, R. E. R.	4	Salmon, Gimlet and Jam	June	Disc	4	Springtyne cultivated September Harrowed March	Nabawa	3rd week April	30	80	Dry	Yes	
Swinstead, H. . .	2	Gimlet and Mallee	June	Disc	3	Springtyned September Harrowed in March	Gluyas Early	Early May	26	60	Dry	Yes	Flag Smut
Lecky, J. V. ..	3	Salmon, Gimlet	June	Disc	3	Springtyned September	Nabawa	3rd week April	20	60	Dry	Yes	
Chapman, F. T.	3	Salmon, Gimlet and Morrell	July	Disc	4	Springtyned September. Scarified February Harrowed March	Gluyas Early	Mid April	38	70	Dry	Yes	

Combined cultivator-drills were used by all competitors when planting

50-*acre Competition on Non-Fallow.*

This is the last competition that the Association intends to conduct on unfallowed land, and it was continued this year for the benefit of the farmers who were fallowing for the first time.

The awards were as follow:—

YILGARN PRIMARY PRODUCERS' ASSOCIATION.

NON FALLOW.

Judge: G. L. Throssell, Dip. Agric., Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
Green & McKettrick	Moorine Rock	Gluyas Early	17	9	8	13	14	61
Pickworth, W. ...	Moorine Rock	Gluyas Early	15	9	8	14	13	59
Luxton, R. J. ...	Moorine Rock	Gluyas Early	14	9	9	13	13	58
Whan, T. J. ...	Moorine Rock	Gluyas Early	13	9	8	13	13	56
Liddell & Carstairs	Moorine Rock	Gluyas Early	13	9	9	12	12	55
Trundle, W. ...	Moorine Rock	Nabawa ...	12	9	9	13	12	55
Becker & Hough	Turkey Hill	Gluyas Early	12	9	8	14	12	55
F. & J. Davies	Corinthian ...	Gluyas Early	12	9	9	12	12	54

Messrs. Green and McKettrick's entry of the variety Gluyas Early was outstanding. It was calculated to yield 17 bushels per acre and was awarded 61 points. Its chief defect was the presence of Flag Smut, which was found in a number of crops in the district. The land originally carried salmon gum, gimlet and teatree timber and had been cropped twice previously. It received no working prior to seeding, the stubble being burnt and the crop planted with the combined cultivator-drill.

Mr. Pickworth's entry, also of the variety Gluyas Early, was placed second with 59 points. This land was being cropped for the second time and received a cultivation in March.

The following table summarises the cultural methods:—

CULTURAL DETAILS—NON FALLOW.

Competitor.	Timber.	No. of years cropped.	Cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Diseases.
Green & McKettrick	Salmon, Gimlet, Teatree	3	None ...	Gluyas Early	Mid. April	30	65	Flag Smut
Pickworth W. ...	Morrell, Salmon, Gimlet	2	Cultivated in March	Gluyas Early	Mid May	25	60	Flag Smut
Luxton, R. J. ...	Gimlet, Mallee	1	None ...	Gluyas Early	End April	25	60	
Whan, T. J. ...	Gimlet, Teatree	1	None ...	Gluyas Early	Early May	25	60	Flag Smut
Liddell & Carstairs	Mallee, Gimlet	2	None ...	Gluyas Early	3rd wk. April	34	60	
Trundle, W. ...	Mallee, Morrell	2	None ...	Nabawa	End April	30	65	
Davies, F. & J.	Gimlet ...	1	Cultivated in March	Gluyas Early	Early May	35	80	
Becker & Hough	Salmon, Gimlet, Boree	3	Harrowed February, Cultivated April	Gluyas Early	Early May	30	45	Flag Smut

All competitors graded and dry pickled, and used combined cultivator drills.

ZONE 5.

The competitors eligible to compete for the Zone Championship awards in this zone were those entries forwarded to the Royal Agricultural Society from the Doodlakine-Baandee and Merredin District Agricultural Societies, and also from one competitor direct.

The Bruce Rock Agricultural Society also conducted a competition, but unfortunately these entries were not received by the Secretary of the Royal Agricultural Society before the date fixed for the closing of the Zone Competition.

DOODLAKINE-BAANDEE AGRICULTURAL SOCIETY.

Judge—G. L. THROSSELL, Dip. Agric., Agricultural Adviser.

For this competition five entries were received, three from Doodlakine and two from Baandee. The rainfall at these centres was as follows:—

...—	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	May to Oct.	Jan. to Oct.
Doodlakine	...	162	120	3	203	322	183	130	8	28	874	1,159
North Baandee	64	184	?	5	406	342	153	91	7	50	1,049	?

The season started well, but the lack of rain at the critical periods minimised the chances of a record harvest. North Baandee registered 157 points more than Doodlakine during the growing period.

The awards are set out in the following table:—

DOODLAKINE-BAANDEE AGRICULTURAL SOCIETY.

ZONE 5.

Judge: G. L. Throssell, Dip. Agric., Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
Prowse Bros. ...	Doodlakine...	Nabawa ...	22	9	9	14	13	67
Prowse, E. W....	Doodlakine...	Gluyas Early	20	8	8	14	13	63
Prowse, A. E. C.	Doodlakine...	Gluyas Early	19	8	8	14	13	62
Spillman, J. W.	Baandee ...	Merredin ...	17	7	7	13	12	56
Spillman, D. J.	Baandee ...	Merredin ...	15	8	8	13	12	56

The competition was won by Messrs. Prowse Bros., whose crop of Nabawa, part of a paddock of 280 acres of the same variety, was awarded 67 points with a calculated yield of 22 bushels, equivalent to 2½ bushels per inch of rain during the growing period. The land was mouldboard ploughed in June and springtyne cultivated in September, after which it was rolled to break the clods. It was tandem disced and harrowed in February. The crop was well grown and, had the season finished more favourably, would have yielded considerably more than 22 bushels.

Mr. E. W. Prowse was placed second, scoring 63 points with a crop of Gluyas Early. This entry lost points for traces of Flag Smut and Bunt. The cultural details are as follow:—

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber.	When fallowed.	Implement.	Death.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Pickled.	Graded.	Disease.
Prowse Bros. ...	Since 1912	Salmon, Gimlet, Teatree	June	Mouldboard	ins. 4	Springtyned and rolled Sept. Tandem disced and harrowed Feb.	Nabawa	End April ...	45	100	Yes	Yes	Takeall
Prowse, E. W. ...	9	Salmon Gimlet	July	Disc.	3½	Springtyned Oct. Portion rolled Feb. Springtyned Mar.	Gluyas Early	End May ...	45	90	Yes	Yes	Flag Smut, Bunt, Takeall
Prowse, A. E. C.	?	Salmon and Gimlet	June	Mouldboard	4	Springtyned Aug. and Sept., and prior to seeding	Gluyas Early	Mid May ...	45	100	Yes	Yes	Flag Smut, Takeall.
Spillman, J. W.	7	Salmon, Gimlet and Morrel	June-July	Sundercut	4	Springtyned Sept. and Oct., and prior to seeding	Merredin	Early May ...	55	90	Yes	Yes	Takeall, Flag Smut.
Spillman, D. J.	Since 1922	Salmon, Gimlet	July	Disc	4	Springtyned prior to seeding	Merredin	Early May ...	45	90	Yes	Yes	Flag Smut.

MERREDIN DISTRICT AGRICULTURAL SOCIETY.

Judge—G. L. THROSSELL, Dip. Agric., Agricultural Adviser.

Of the twenty-four entries received, fourteen crops were submitted for judging in this competition. It is to be regretted that such a large number withdraw each year from this Society's Crop Competition.

The rainfalls recorded at various places throughout the district were as follow:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	May to Oct.	Jan. to Oct.
Merredin Exp. Farm	50	162	77	...	357	309	119	94	13	35	927	1,216
South Walgoolan	10	222	78	...	283	236	106	82	9	35	751	1,061
Walgoolan...	...	175	75	...	380	280	113	64	13	93	943	1,193
Talgomine	14	129	84	...	399	269	70	68	14	72	892	1,119
Totadgin ...	46	118	81	...	411	335	195	129	20	39	1,129	1,374
Nukarni ..	10	173	85	2	322	270	103	77	15	64	861	1,131

The points awarded are shown in the following table:—

MERREDIN AGRICULTURAL SOCIETY.

Judge—G. L. Throssell.

Competitor.	District	Variety.	Points. Yield.	Weeds	Disease.	Admixture.	Evenness.	Total.
W. Cook	South Walgoolan	Nabawa ..	26	9	9	13	14	71
H. W. Teasdale ...	Totadgin ...	Nabawa ...	25	9	9	14	13	70
C. Rowan	Merredin ...	Nabawa ...	24	9	9	14	13	69
F. O. Teasdale ...	Korbel	Merredin ...	24	9	7	14	14	68
J. B. Lambert ..	South Burracoppin	Merredin ...	24	9	7	13	14	67
W. S. Crouch ...	South Burracoppin	Nabawa ...	22	9	9	13	14	67
T. G. and J. Maughan	Nukarni	Merredin ...	23	8	7	14	14	66
R. M. King .	South Walgoolan	Gluyas Early..	21	9	8	14	14	66
T. H Smallacombe	Nangeenan .	Canberra ...	22	8	7	14	13	64
Barnett Bros. ...	North Walgoolan	Gluyas Early ..	21	9	8	13	13	64
J. D. Maughan ...	South Walgoolan	Nabawa ...	20	8	9	13	13	63
J. E. Clothier ...	Totadgin .	Nabawa ...	19	8	8	14	13	62
L. Dunsday ...	Talgomine ...	Nabawa ...	18	9	8	13	13	61
J. S. Priestly ...	Merredin ...	Gluyas Early ...	15	9	8	14	12	58

The winner was W. Cook of South Walgoolan, who entered the Zone Competition for the first time and who was placed third in the fallow competition. His crop of Nabawa was awarded 71 points and was calculated to yield 26 bushels per acre.

Mr. H. W. Teasdale's crop of Nabawa gained second place with 70 points with a yield of 25 bushels per acre.

As the table of awards will show, Nabawa still maintains its popularity in this district. Several good crops of Merredin were shown as well as Gluyas Early and Canberra. While these three varieties are good early wheats, they are all very susceptible to the disease Flag Smut. Nabawa, on the other hand, is very resistant. No Bunt was found in any competition crops, although traces of Take-all were present in several.

The methods of cultivation of the various competitors are as follows:—

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber.	When fallowed.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Pickled.	Graded.	Disease.
Cook, W. ...	3	Salmon and Gimlet	Early July	Disc	in. 3	Scarified in August and September. Springtyne cultivated in January and February	Nabawa	Mid-May ...	43	80	Yes	Yes	Takeall.
Teasdale, H. W.	5	Gimlet ...	July	Disc	in. 3½	Scarified in September. Springtyne cultivated in February	Nabawa	1st week May	45	97	Yes	Yes	Takeall.
Rowan, C. ...	3	Salmon and Gimlet	June and July	Mould-board	in. 3	Springtyne cultivated in August and again in October. Springtyne cultivated and harrowed prior to seeding	Nabawa	3rd week May	50	112	...	Yes	Takeall.
Teasdale, F. O....	...	Gimlet and Morrell	June and July	Mould-board	in. 3½	Springtyne cultivated in September and October and again in February	Merredin	1st week May	45	93	Yes	Yes	Flagsmut and Takeall.
Lambert, J. B.	4	Salmon and Gimlet	July	Disc	in. 3–4	Scarified twice in April	Merredin	1st week May	45	90	Yes	Yes	Flag Smut and Takeall.
Crouch, W. S. ...	...	Salmon and Gimlet	July and August	Mould-board	in. 6	Springtyne cultivated in February	Nabawa	End March ...	50	90	Yes	Yes	Takeall.
Maughan, T. G., and J.	...	Gimlet and Morrell	June and August	Mould-board	in. 3–4	Springtyne cultivated in August. Harrowed in September. Springtyne cultivated and harrowed in February and March	Merredin	End May ...	50	90	Yes	Yes	Flag Smut.

CULTURAL DETAILS—*continued.*

Competitor	No. years cropped	Timber	When fallowed	Implement	Depth	Subsequent cultivations	Variety	Planted	Rate of Seed	Rate of Super	Pickled	Graded	Disease
King, R. M.	4	Gimlet	June	Disc	in. 4	Disced in August. Springtyned cultivated in October and again in March	Gluyas Early	Early May	45	90	Yes	Yes	Flag Smut
Smallacombe, T. H.		Gimlet, Salmon, Jam and Mallee	July	Di[sc]	4	Springtyne cultivated in September and October and again in April	Canberra	Mid May	60	90	Yes	Yes	Flag Smut and Takeall
Barnett Bros.	3	Salmon and Gimlet	July	Disc	4	Springtyne cultivated in August and September. Portion skim ploughed in October and balance springtyne cultivated. Harrowed in February	Gluyas Early	Early May	43	87	Yes	Yes	Flag Smut
Maughan, J. D.	3	Mallee, Teatree and Gimlet	Early June	Disc	3–4	Re-disced in July and end of August. Springtyne cultivated in January	Nabawa	Early May	45	90	Yes	Yes	Flag Smut
Clothier, J. E.	10	Salmon and Gimlet	August	Disc	4	Springtyne cultivated in September. Harrowed in February	Nabawa	Early May	45	90	Yes	Yes	Takeall
Dumsday, I.	2	Salmon, Gimlet and Jam	March	Rigid tyne scarifier	3	Scarified in September. Springtyne cultivated in February and harrowed in March	Nabawa	End April	45	90	Yes	Yes	Takeall

CULTURAL DETAILS.—*continued.*

Competitor.	No. years. cropped.	Timber.	When fallowed.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Pickled.	Graded.	Disease.
					in.								
Priestly, J. S. ...	6	Morrel, Gimlet and Wodjil	August	Disc	...	Springtyne, cultivated in September. Harrowed in February and springtyne cultivated prior to seeding	Gluyas Early	1st week May...	35	90	Yes	Yes	Flag Smut and Takeall.

ROYAL AGRICULTURAL SOCIETY.

Judge—G. L. THROSSELL, Dip. Agric., Agricultural Adviser.

As no competition was conducted in the Meckering district, the entry of Mr. M. H. Reynolds was received direct by the Royal Agricultural Society.

The rainfall for Meckering was as follows:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.						May to Oct.	Jan. to Oct.
					May.	June.	July.	Aug.	Sept.	Oct.		
Meckering ...	2	63	110	3	250	429	250	141	36	90	1,196	1,374

The points awarded are as follow:—

Competitor.	Variety.	Yield. 50 points.	Freedom from—			Evenness of growth 15 points.	Total. 100
			Weeds. 10 points.	Disease. 10 points.	Admixture. 15 points.		
M. H. Reynolds, Meckering ...	Gresley ...	20	9	9	14	13	65

This was a very well grown crop, being very free of weeds, disease and admixture, but rather uneven.

The cultural methods were as under:—

CULTURAL DETAILS.

Competitor.	Timber.	When fallowed.	Implement.	Depth.	Subsequent cultivations.
				in.	
Reynolds, M. H. ...	York Gum, Jam and Morrel	August ...	Mouldboard	5	Springtyne cultivated in September

Competitor.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Treated.	Graded.
Reynolds, M. H. ...	Gresley ...	Mid May ...	70	90	Dry pickled	Yes

BRUCE ROCK AGRICULTURAL SOCIETY.

Judge—G. L. THROSSELL, Dip. Agric., Agricultural Adviser.

The Bruce Rock Agricultural Society conducted two crop competitions, one an open competition and the other confined to those crops grown on the competition fallow.

The rainfalls for various stations in the locality were as hereunder:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.						May to Oct.	Jan. to Oct.
					May.	June.	July.	Aug.	Sept.	Oct.		
Bruce Rock	...	55	114	7	254	312	216	120	21	41	964	1,140
Babakin ...	...	25	140	...	271	355	180	82	20	57	971	1,136
Central Kumminin	11	44	120	...	236	335	184	110	28	31	923	1,098

Had the months of September and October received the average rainfall it is expected that a record harvest would have resulted for this district. Although an unfavourable season was experienced, particularly good yields have been obtained.

50 acre Crop Competition.

Messrs. C. Smith and Sons, of Yarding, succeeded in winning this competition from seventeen other competitors, all of whom submitted crops which yielded better than sixteen bushels per acre. The winning crop was of the variety Gluclub and was calculated to yield 29 bushels per acre. In preparation for this crop the land was June fallowed, disc cultivated in August and springtyne cultivated in September. The crop was planted early in May and sown at the rate of 45 lbs. of seed and 93 lbs. of superphosphate per acre. The crop was very well grown, but lost points for unevenness in the vicinity of a lake. As was the case in all the crops of the variety, Gluclub, in the competition, admixture was noticeable. Points were lost for traces of Flag Smut and Takeall.

The points awarded are as follow:—

BRUCE ROCK AGRICULTURAL SOCIETY.

Judge: G. L. Throssell.

Competitor.	District.	Variety.	Points.					
			Yield. 50	Weeds. 10	Disease. 10	Admixture. 15	Evenness. 15	Total 100
C. Smith & Sons ...	Yarding	Gluclub ...	29	9	9	13	13	73
Buller & Black ...	Babakin	Gallipoli ...	27	9	8	14	14	72
R. Mann	Sth. Shackleton	Gluclub ...	27	9	8	13	14	71
C. & A. H. Smith ...	Yalbarin ...	Gluclub ...	28	9	8	13	13	71
P. Strange	Eujinyn ...	Gluclub ...	27	9	8	13	13	70
W. Arnold	Yalbarin ...	Gluclub ...	27	8	7	13	14	69
H. D. Jacob ...	Erikin	Gluclub ...	26	9	8	13	13	69
C. E. & N. S. Schilling	Bungulluping ...	Gluclub ...	24	9	8	13	13	67
H. E. Francis ...	Babakin	Waratah ...	22	8	9	14	13	66
G. E. Robins & Co.	Babakin	Gluclub ...	22	9	8	13	13	65
E. G. Ellis	Central Kuminin	Gluclub ...	22	8	8	13	12	63
B. Altham	Yalbarin ...	Gluclub ...	21	8	8	13	13	63
J. W. Bristow ...	Ardath	Merredin ...	21	8	7	13	14	63
W. D. Johnson ...	Bruce Rock ...	Gluclub ...	21	9	7	13	13	63
Allen Bros. ...	Central Kuminin	Gluyas Early	20	8	7	14	13	62
D. H. Faulkiner ...	Babakin	Nabawa ...	18	9	9	13	12	61
B. Altham	Yalbarin	Nabawa ...	17	7	8	13	12	57
A. H. Norris ...	Belka	Nabawa ...	16	7	8	13	12	56

This is a *local* competition and not entered with the Royal.

Messrs. Buller and Black, of Babakin, came second with a crop of the variety Gallipoli. The crop also won the combined Crop and Fallow Competition.

Of the eighteen entries no less than eleven were of the variety Gluclub, which is a very popular variety in this district. This variety is a good yielder and stands well. It has, however, defects which prevent its being recommended as a standard variety. In addition to shedding its grain readily, Gluclub is not resistant to diseases and its milling qualities are below standard. The last-named defect is most serious from the miller's point of view. It is obvious that if varieties of low milling qualities are grown to a large extent, our present standard of wheat exported will be lowered and the price affected accordingly.

The cultural methods of the competitors are shown in the following table:—

CULTURAL DETAILS.

Competitor.	No. years. cropped.	Timber.	When fallowed.	Implement.	Depth.	Subsequent cultivations	Variety.	Planted.	Rate of Seed.	Rate of Super.	Pickled.	Graded.	Disease.
Smith, C. & Sons	3	Salmon, Gimlet, and Teatree	June	Disc	ins. 3	Disced in August. Springtyne cultivated in September	Gluclub	Early May ...	45	93	Yes	Yes	Takeall and Flag Smut.
Buller & Black	...	Salmon, Gimlet, and Morrell	June	Disc	3	Springtyne cultivated in August, and half in Sept. Balance scarified in Sept. Harrowed in March and scarified prior to seeding	Gallipoli	Mid May ...	50	95	Yes	Yes	Flag Smut.
Mann, R. ...	6	Salmon and Gimlet	Late July and Aug.	Mouldboard	3–4	Springtyne cultivated in September, scarified and harrowed in early October. Scarified in April	Gluclub	3rd week April	60	112	Yes	Yes	Flag Smut and Takeall
Smith, C. and A. H.	...	Salmon, Gimlet, and Morrell	June	Mouldboard	3	Disced in August. and October	Gluclub	Early May ...	45	90	Yes	Yes	Flag Smut and Takeall
Strange, P. ...	8	Morrell, Yorrell, and Gimlet	June	Disc	3½	Springtyne cultivated in September, and again in April	Gluclub	Early May ...	48	100	Yes	Yes	Flag Smut.
Arnold, W. ...	...	Salmon and Gimlet	July	Rigid tyne scarifier	3	Disced at end of August and springtyne cultivated in March	Gluclub	Early May ...	45	90	Yes	Yes	Flag Smut and Takeall.
Jacob, H. D. ...	...	Salmon and Gimlet	July	Disc	3	Scarified in September	Gluclub	Early May ...	50	90	Yes	Yes	Flag Smut and Takeall.

CULTURAL DETAILS—*continued.*

Competitor.	No. years cropped.	Timber.	When fallowed.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Pickled.	Graded.	Disease.
Schilling, C. E. & N. S.	4	Salmon and Gimlet	Early June	Disc	ins. 3–4	Harrowed in June. Scarified early July. Springtyne cultivated end of July and September. Scarified early May	Gluclub	Early May ...	60	75	Yes	Yes	Flag Smut and Takeall.
Francis, H. E.	...	Salmon, Gimlet and Jam	June	Disc	4	Scarified in September. Harrowed in September, and again prior to seeding	Waratah	3rd week April	50	90	Yes	Yes	Bunt and Takeall.
Robins, G. E. & Co.	7	Salmon, Gimlet and Morrell	End Jan.	Disc	4	Scarified mid. July, harrowed in August Springtyne cultivated in September. Harrowed in October	Gluclub	Early May ...	45	112	Yes	Yes	Bunt and Takeall.
Ellis, E. G. ...	...	Salmon and Gimlet	Early June	Disc	3	Harrowed in July. Disced end of July. Springtyne cultivated early August and again in March and May	Gluclub	Mid May ...	50	90	Yes	Yes	Flag Smut.
Altham, B. ...	4	Salmon and Gimlet	June	Mouldboard	3½	Disced in September. Springtyne cultivated in October and twice in April	Gluclub	End April ...	45	90	Yes	Yes	Bunt and Takeall.
Bristow, J. W.	...	Salmon, Gimlet and Morrell	June	Rigid tyne scarifier	3	Scarified in July-August. Springtyne cultivated in September and March	Merredin	3rd week May	60	90	Yes	Yes	Flag Smut Takeall and Bunt.

CULTURAL DETAILS—*continued.*

Competitor.	No. years cropped.	Timber.	When fallowed.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Pickled.	Graded.	Disease.
Johnson, W. D.	...	Salmon and Gimlet	July and August	Mould-board	ins. 4	Springtyne cultivated in August and September	Gluclub	End April ...	50	90	Yes	Yes	Flag Smut and Bunt.
Allen, Bros. ...	5	Salmon and Gimlet	June	Rigid tyne scarifier	3	Scarified in September. Springtyne cultivated in Mar.	Gluyas Early	End May ...	50	90	Yes	Yes	Flag Smut and Bunt.
Faulkner, D. ...	7	Salmon, Gimlet and Jam	July	Mould-board	3–4	Disced in August. Springtyne cultivated in April	Nabawa	End April ...	60	80	Yes	Recleaned	Takeall.
Altham, B. ...	6	Salmon and Gimlet	July	Mould-board	3½	Disced in September. Springtyne cultivated in October, and twice in April.	Nabawa	End April ...	45	90	Yes	Yes	Takeall.
Norris, H. H. ...	...	Salmon ...	July	Disc	3½–4	Disced in September. Harrowed twice in October	Nabawa	Mid May ...	55	95	Yes	Yes	Bunt and Takeall.

50 acre Fallow and Crop Competition.

Messrs. Buller and Black, of Babakin, won this competition with a crop of Gallipoli which was awarded a total of 72 points, with a calculated yield of 27 bushels per acre, equivalent to 2.8 bushels per inch of rain during the growing period. This variety is short strawed being on an average less than three feet high. It was very free of weeds and admixture, and a little Flag Smut was present.

This entry also wins the combined Crop and Fallow Competition, defeating the winning fallow of C. E. & N. S. Schilling by two points.

The points awarded are as follow:—

BRUCE ROCK AGRICULTURAL SOCIETY.

FALLOW AND CROP Competition.

Judge—G. L. THROSSELL.

Competitor.	District.	Variety.	Points. Yield.	Weeds.	Disease.	Admixture.	Evenness.	Total. 100	Total fallow. 100	Aggregate. 200
Buller & Black ...	Babakin	Gallipoli ...	27	9	8	14	14	72	88	160
C. E. and N. S. Schilling ...	Bungulluping ...	Merredin ...	23	9	8	13	14	68	91	159
R. Mann	South Shackleton	Gluclub ...	27	9	8	13	14	71	87	158
E. G. Ellis	Central Kunjinin	Gluclub ...	22	8	8	13	12	63	91	154
W. D. Johnson	Bruce Rock	Gluclub ...	21	9	7	13	13	63	85	148
G. E. Robins & Co. ...	Babakin	Gluclub ...	22	9	8	13	13	65	83	148
Allen Bros.	Central Kunjinin	Nabawa ...	17	7	9	14	12	59	86	145

Mr. R. Mann, of South Shackleton, was awarded 71 points for a crop of Gluclub which should also yield 27 bushels per acre.

The following table shows the cultural methods of the competitors:—

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber.	When fallowed.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Treated.	Graded.	Disease.
Buller and Black		Salmon, Gimlet and Morrel	June	Disc	ins. 3	Springtyne cultivated in August, half springtyne cultivated and half scarified in September. Harrowed in March. Scarified prior to seeding	Gallipoli	Mid May	50	95	Yes	Yes	Flag Smut and Takeall
Schilling, C. E. and N. S.	4	Salmon and Gimlet	Early June	Disc	3–4	Harrowed in June, scarified early July, springtyne cultivated end of July and September. Scarified early May	Merredin	3rd week May	60	?	Yes	Yes	Flag Smut and Takeall
Mann, R.	6	Salmon and Gimlet	Late July and August	Mouldboard	3–4	Springtyne cultivated in September, scarified and harrowed in early October, scarified in April	Gluclub	3rd week April	60	112	Yes	Yes	Flag Smut and Takeall
Ellis, E. G.		Salmon and Gimlet	Early June	Disc	3	Harrowed in July, Dodded end of July. Springtyne cultivated early August and again in March and May	Gluclub	Mid May	50	90	Yes	Yes	Flag Smut
Johnson, W. D.		Salmon and Gimlet	July and August	Mouldboard	4	Springtyne cultivated in August and September	Gluclub	End April	50	90	Yes	Yes	Flag Smut and Bunt

CULTURAL DETAILS—*continued.*

Competitor.	No. years cropped.	Timber.	When fallowed.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Treated.	Graded.	Disease.
Robins, G. E. & Co.	7	Salmon, Gimlet and Morrell	End of Jan.	Disc	ins. 4	Scarified mid-July Harrowed in August Springtyne cultivated in September Harrowed in October	Gluclub	Early May ...	45	112	Yes	Recleaned	Bunt and Take Takeall.
Allen Bros. ...	5	Salmon and Gimlet	June	Rigid-tune Scarifier	3	Scarified in September Springtyne cultivated in March	Nabawa	Early May ...	50	90	Yes	Yes	Takeall.

ZONE 7.

In this zone three district agricultural societies, Kulin, Lake Grace and Corrigin, conducted crop competitions. The last-named however, failed to forward entries to the Royal Agricultural Society, and the competitors were consequently not eligible to compete for the zone championship prizes.

KULIN DISTRICT AGRICULTURAL SOCIETY.

Judge—J. H. LANGFIELD, Manager, Merredin Expt. Farm.

For this Society's competition 13 crops were inspected and all gave promise of satisfactory yields. The highest yield was calculated at 28 bushels per acre and the lowest at 20 bushels per acre: the average calculated yield for the 13 crops being slightly over 24 bushels per acre.

Ball smut was very bad in several crops and many points were lost on that account. All except one competitor dry pickled, but evidently the operation in several instances had not been carried out thoroughly.

The rainfall registered at the Kulin Post Office is as follows:—

...	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
Kulin ...	36	26	134	40	240	371	190	122	24	25	972	327	1	1,536

The awards were made as follows:—

KULIN AGRICULTURAL SOCIETY.

Judge—J. H. Langfield, Manager, Experiment Farm, Merredin.

Competitor.	Variety.	Estimated Yield. 50 pts.	Freedom from Weeds. 10pts.	Freedom from Disease. 10 pts.	Freedom from Admixture. 15 pts.	Evenness of Growth. 15 pts.	Total Points. 100 pts.
J. H. Henderson ...	Queen Fan ...	28	9	9	13	14	73
A. W. Trotter ...	Bena	26	9	9	14	13	71
F. S. Freebairn ...	Queen Fan ...	26	9	9	14	13	71
R. Nicholls	Merredin	26	8	8	14	14	70
Bailey & Russell ...	Hard Federation ...	28	9	6	13	13	69
Bowey & Baldock ...	Merredin	23	9	8	14	14	68
P. J. Bowey	Merredin	23	9	9	14	13	68
H. Johnston	Yandilla King ...	24	9	7	14	13	67
M. J. Barry	Bena	23	8	9	13	13	66
Roberts Bros. ...	Hard Federation ...	22	8	9	13	14	66
Howe Bros.	Nabawa	22	9	9	13	12	65
P. Meikle	Merredin	20	9	7	14	13	63
J. McNamara ...	Queen Fan ...	23	8	6	13	13	63

The winning crop was of the variety Queen Fan exhibited by Mr. J. H. Henderson. It was rather a popular variety in this district, last year's competition being also won by this variety. It was a very clean, even crop, with very little weed growth, admixture or disease. It did not appear to have suffered to any great extent for want of spring rains, the grain being plump and the ears well filled.

As was the case in last year's competition, Mr. Trotter secured second prize, this year with a crop of Bena, and although hardly up to the standard of the winner, it was a very fine crop.

Messrs. Bailey and Russell's crop of Hard Federation was calculated to yield equal to the winning crop, but it was very bad with ball smut and lost heavily on that account.

Mr. F. S. Freebairn, who won the competition last year, tied for second place with a very fine crop of Queen Fan, being only 2 points below the winning crop.

The following table summarises the cultural methods adopted by the competitors:—

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
Henderson, J. H.	3	Salmon, Gimlet, and Mallee	July	Good	Rigid tyne scarifier.	ins. 3	Springtyne cultivated first week Sept. Harrowed before seeding and planted with combined cultivator-drill.	Queen Fan	Mid May ...	48	112	Dry	Yes	
Trotter, A. W.	Old pdk., many yrs.	Jam ...	June	Good	Disc	3	With 10 furrow disc in Sept. Springtyne before seeding.	Bena	End April ...	60	110	Dry	Yes	
Freebairn, F. S.	2	Morrel, Salmon, and Blackbutt	July	Good	Mouldboard	4	Harrowed 29th Aug. Cultivated with combine 19th Sept., and again Oct. 6th. Light harrows behind combined cultivator-drill at seeding.	Queen Fan	1st week May	60	112	Dry	Yes	
Bailey & Russell	...	Jam and York Gum	July	Good	Disc.	3–4	None	Hard Federation	1st week May	45	120	Dry	Yes	
Bowey & Baldock	3rd crop in 5 years	Salmon Gum	July	Good	Mouldboard	2½	Springtyne cultivated in October. Harrowed March, and planted with combined cultivator drill	Merredin	Mid May ...	50	75	Dry	Yes	
Nicholls, R. ...	Old pdk., many yrs.	Salmon and Gimlet	June	Good	Disc	3–4	Turned back in August. Cultivated September and again before drilling	Merredin	Early May ...	45	90	Dry	Yes	

CULTURAL DETAILS—*continued.*

Competitor.	No. years cropped.	Timber.	When fal-lowed.	Condition of land.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
Bowey, P. J. ...	3	Salmon and Morrel	July	Good	Disc	ins. 3	Twice with springtyne in Spring, and once in April. Planted with combined cultivator drill	Merredin	Mid May ...	55	80	Dry	Yes	
Johnston, H. ...	1	Salmon and Morrel	June	Good	Disc	4	Cultivated in Aug. and sown with combined cultivator-drill	Yandilla King	Mid May ...	45	90	Dry	Re-winnowed	
Barry, M. J. ...	3	Gimlet, Salmon and Morrel	July	Good	Disc	3½	Sundercut in Oct. and cultivated before seeding	Bena	Mid April ...	37	100	No	Yes	
Howe, Bros. ...	7	Jam, Salmon, Gimlet and Morrel	July	Good	Mould-board	3½	Springtyne cultivated in August, again in Sept., and before seeding Planted with Combined cultivator-drill	Nabawa	Early May ...	56	100	Dry	Re-winnowed	
Meikle, P. ...	...	Gimlet and Salmon	July	Good	Mould-board	3½	Springtyne cultivated before seeding. Combined and harrowed after	Merredin	Mid May ...	45	90	Dry	Yes	
McNamara, J. ...	3	Jam, York Gum and Gimlet	July	Good	Disc	3½	Springtyne cultivated in Spring. Harrowed twice April, and cultivated ahead of drill	Queen Fan	1st week May...	45	90	Dry	Yes	

LAKE GRACE AGRICULTURAL SOCIETY.

Judge—J. H. LANGFIELD, Manager, Merredin Expt. Farm.

For the above competition nine crops were inspected. The following table gives points awarded:—

LAKE GRACE DISTRICT AGRICULTURAL SOCIETY.

Judge: J. H. Langfield, Manager, Merredin Experimental Farm.

Competitor.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total, 100 points.
O. F. Haddon ...	Nabawa	27	8	9	14	13	71
A. H. Darby ...	Gluyas Early ...	26	8	9	14	13	70
H. Bishop	Nabawa	25	8	9	14	13	69
J. Ley	Gluyas Early ...	23	9	9	14	13	68
H. J. Coad	Nabawa	22	9	9	14	13	67
F. Stephens	Waratah	22	9	9	14	13	67
E. Fry	Bena	21	8	9	14	14	66
C. Griffin	Federation	23	8	8	13	13	65
G. Argent	Nabawa	22	8	8	14	13	65

Mr. O. F. Hadden's crop, which secured first place, was of the variety Nabawa; it was even, well headed and free from disease, and contained very little weed growth. It was calculated to yield 27 bushels per acre.

Mr. A. H. Darby secured second place with a crop of Gluyas Early; unfortunately it had been considerably knocked about by the heavy rains experienced in November and had lodged badly in many places. The calculated yield was 26 bushels per acre.

Mr. H. Bishop was placed third with a crop of Nabawa. This crop was standing very well and had not suffered by the heavy November rains. It was calculated to yield 25 bushels per acre, and, like the first and second crops, showed very little disease or admixture.

The average calculated yield of the nine competing crops in this district was 23 bushels per acre.

The rainfall recorded at Lake Grace is as follows:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
Lake Grace	101	43	81	29	192	340	199	102	57	60	950	386	14	1,604

The cropping particulars of the various competitors are as follow:—

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
						ins.								
Hallen, O. F....	4	Salmon and Blackbutt	Early August	Good	Disc	4	Disced in September. Harrowed in October. Cultivated with Springtyne cultivator before seeding	Nabawa	End April ...	45	70	Dry	No	
Darby, A. H. ...	4	Blackbutt and Morrel	End June	Good	Mouldboard	3½	Duckfoot end of August; three other workings with springtyne cultivator in spring and sown with combined cultivator drill	Gluvas Early	May ...	45	112	Dry	Yes	
Bishop, H. ...	9	Blackbutt, Teatree, and Salmon	July	Good	Disc	3½	Twice in spring with springtyne cultivator and planted with combined cultivator drill	Nabawa	End April ...	45	125	Dry	Yes	
Ley, J. ...	11	Salmon and Gimlet	July	Good	Disc	3	Springtyne cultivated in September and again before planting	Gluvas Early	May	52	75	Dry	Yes	
Coad, H. J. ...	8	Gimlet and Morrel	July, 1927	Good	Disc	3½	Two years fallow. Ploughed twice first year. Cultivated twice following year and before seeding	Nabawa	Mid-May ...	45	150	Dry	Yes	

CULTURAL DETAILS—*continued.*

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted,	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
Stephens, F. ...	6 years with 2 years spell before this crop	Salmon and Morrel	June	Good	Mould-board	ins. 3–4	Springtyne cultivated in September. Disced after March rain and disced before planting	Waratah	End May ...	45	103	Dry	Yes	
Fry, E. ...	2	Morrel, Tea-tree, and Gimlet	July	Good	Disc	3½	Springtyne cultivated in September. Disced January and again before seeding	Bena	1st week May	42	112	Dry	Yes	
Griffen, C. ...	7	Salmon and Gimlet	July	Good	Mould-board	4	Springtyne cultivated in spring and before seeding	Federation	May	50	112	Formalin	Yes	
Argent, G. ...	3	Salmon, Gimlet, and Blackbutt	August	Good	Ten furrow Disc	3–4	Springtyne cultivated in March and harrowed after drilling	Nabawa	Mid-May ...	50	90	Bluestone	No	

CORRIGIN AGRICULTURAL SOCIETY.

Judge—G. L. THROSSELL, Dip. Agric., Agricultural Adviser.

This Society conducted two local crop competitions, one on heavy land and the other on light land. However, the number of entries obtained was disappointing, there being only five in the former competition and three in the latter.

As elsewhere this season, heavy rains were recorded during the early part of the growing period, but only 74 points were registered in September and October, and consequently the crops did not finish up to earlier expectations, but nevertheless they have yielded very well. The excessive rains of May and June were a disadvantage to the light lands, being responsible for leaching or washing out the nitrates, also lowering the soil temperatures and so retarding growth and root development, particularly in the late sown crops.

The rainfall recorded during the year was as hereunder:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	May to Oct.	Jan. to Oct.
Corrigin ...	28	24	133	13	333	418	177	104	50	24	1,106	1,304
Kurren-kutten	...	...	191	...	320	385	229	87	28	8	1,057	1,248

50 *Acre Competition on Heavy Land.*

The points awarded are as follow:—

CORRIGIN AGRICULTURAL SOCIETY.

HEAVY LAND. Judge—G. L. Throssell, Dip. Agric., Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
Bremner, J. R. & Sons	Kurren Kutten	Gluyas Early	25	9	9	14	13	70
McAndrew, R. ...	Corrigin ...	Nabawa ...	23	9	8	13	13	66
Taylor, L. G. ...	Kunjin ...	Nabawa ...	18	9	9	13	12	61
Jewell, J. D. ...	Gorge Rock	Federation ...	20	8	9	10	13	60
Taylor, J. B., Jr.	Kunjin ...	Boolaroo ...	15	8	8	13	13	57

This competition was won by Messrs. J. R. Bremner and Sons, of Kurren-Kutten, following up their previous successes in both the crop and fallow competitions last year. The crop of Gluyas Early submitted was calculated to yield 25 bushels per acre (equivalent to 2.4 bushels per inch of rain in the growing period) and was awarded 70 points. Though not actually on the identical piece of fallow which won the fallow competition, this entry was in the same paddock and received similar treatment to the land which won the fallowing competition. The land was scarified with a rigid tyne cultivator after rain in March, springtyned to kill weeds in June and July, harrowed in August, and scarified in September. The crop was very true to type and except for a little Take-all was free of disease. Whilst it was showing a tendency to lodge, no difficulty was being experienced in handling it with a header harvester.

Mr. R. McAndrew's crop of Nabawa was awarded 66 points, with a calculated yield of 23 bushels. This was a very well grown crop, but lost points for weeds, and the presence of Takeall and Bunt.

It shows that a healthy rivalry exists among the competitors in this district, when Mr. J. D. Jewell, who had already stripped his competition crop, submitted another crop which he anticipated would yield several bushels less than the one already harvested.

The following table shows the cultural details:—

CULTURAL DETAILS (HEAVY LAND).

Competitor.	No years cropped.	Timber.	When fallowed	Implement.	Depth.	Subsequent Cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Disease.
remner, J. B. & Sons	8	Salmon, Gimlet, Mallee	March	Scarified with rigid tyne cultivator	in. 3	Springtyne cultivated June and July. Harrowed August. Scarified September.	Gluyas Early ...	3rd week May	47	130	Trace Takeall.
cAndrew, B.	6	Salmon, Gimlet ...	July	Mouldboard ...	4	Springtyned August and September	Nabawa ...	End April ...	52	95	Takeall and Bunt.
aylor, L. G.	?	Salmon, York Gum	July	Mouldboard ...	4	Tandem disced October and March	Nabawa ...	3rd week May	54	85	Takeall.
swell, J. D.	3	Jam, York Gum, Salmon	July	Sundercut ...	4	Scarified with rigid-tyne cultivator September.	Federation ...	Mid May ...	46	90	Takeall
aylor, J. B., Jnr. ...	?	Jam, York Gum	July	Disc	3	Skim ploughed prior seeding	Boolaroo ...	1st week June	54	85	Flag smut Takeall.

All entries dry pickled and graded.

50 Acre Competition on Light Land.

The awards are as follow:—

CORRIGIN AGRICULTURAL SOCIETY.

Judge: G. L. Throssell, Dip. Agric., Agricultural Adviser.

LIGHT LAND.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
Abi Bros. ...	Bilbarin ...	Nabawa ...	16	9	9	13	13	60
Ding, J. B. ...	Corrigin ...	Hard Federation	10	9	8	13	14	54
Ding, J. B. ...	Corrigin ...	Merredin ...	9	9	9	12	12	51

The three entries were all on new land fallowed and cropped for the first time. The winners were Messrs. Abi Bros. of Bilbarin, whose crop of Nabawa, calculated to yield 16 bushels, was awarded 60 points.

Mr. J. B. Ding's entry of Hard Federation scored 54 points, and his Merredin 51 points.

The cultural details are shown in the accompanying table.

CULTURAL DETAILS (LIGHT LAND).

Competitor.	Years cropped.	When fallowed.	Depth.	Implement.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Disease.
Abi Bros.	1	July	ins. 3	Disc.	Disced in April	Nabawa	Early May	60	112	
Ding, J. B.	1	June	ins. 4	Disc	Tandem disced prior seeding. Harrowed after	Hard Federation	Early May	45	120	Flag Smut
Ding, J. B.	1	July	ins. 4	Disc	Tandem disced prior seeding. Harrowed after	Merredin	1st wk. June	45	120	Flag Smut

ZONE 8.

Judge—A. S. Wild, B.Sc. (Agric.), Agricultural Adviser.

Two Agricultural Societies, those of Gnowangerup and Wickepin respectively, conducted crop competitions in Zone 8. The entrants in these competitions were eligible to compete in the Royal Agricultural Society's zone competition as also were the four competitors who entered direct with the Royal Agricultural Society.

GNOWANGERUP AGRICULTURAL SOCIETY.

Twenty entries were received in the competition of the Gnowangerup Agricultural Society. Of these sixteen submitted crops for inspection, the awards being as follow:—

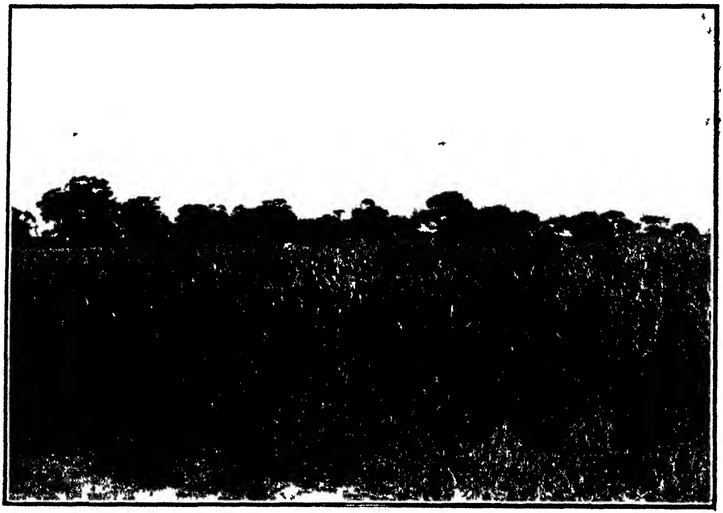
GNOWANGERUP AGRICULTURAL SOCIETY.

Judge: A. S. Wild, B.Sc. (Agric.), Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
C. E. Cockram ...	Pallinup ...	Yandilla King	46	9	9	13	14	91
J. McDonald ...	Gnowangerup	Bena ...	41	9	9	14	14	87
H. O. Beck ...	Gnowangerup	Yandilla King	43	8	9	13	13	86
R. Formby & Co.	Gnowangerup	Nabawa ...	38	9	9	13	13	82
Alf. Johnson ...	Gnowangerup	Bena ...	36	9	8	14	14	81
E. Chambers ...	Pallinup ...	Yandilla King	34	9	9	14	13	79
C. E. Barnard ...	Pallinup ...	Yandilla King	35	8	8	14	13	78
J. Baxter ...	Pallinup ...	Major ...	35	8	8	13	14	78
A. Simpson ...	Pallinup ...	Drof ...	35	8	8	13	14	78
A . White ...	Pallinup ...	Yandilla King	32	9	9	14	14	78
N. L. F. Davis ...	Pallinup ...	Nabawa ...	35	7	9	14	12	77
C Taylor ...	Pallinup ...	Yandilla King	32	8	9	14	13	76
W. Lloyd-Wood	Pallinup ...	Nabawa ...	32	9	9	13	13	76
C. A. Whyatt ...	Pallinup ...	Nabawa ...	32	8	8	14	13	75
E. H. Wright ...	Pallinup ...	Yandilla King	31	7	8	14	13	73
E. A. Gillespie...	Pallinup ...	Drof ...	29	8	8	14	13	72

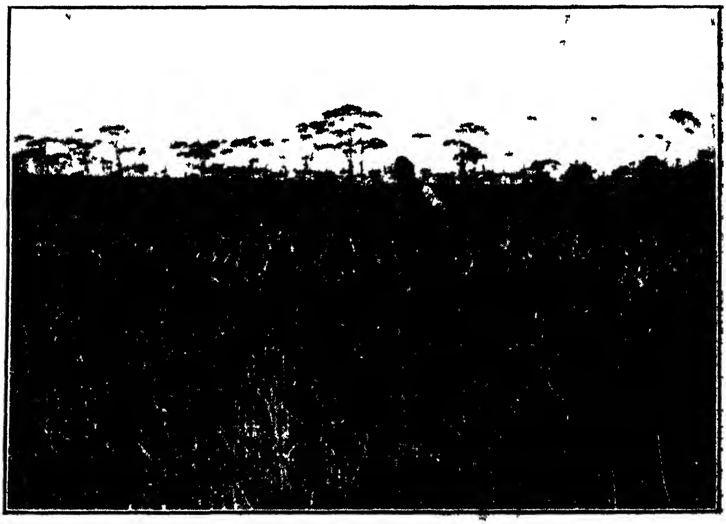
Farley Photos., Gnowangerup.

C. E. Cockram's 50 acres "Yandilla King."
Championship Prize No. 8 Zone; Royal Ag. Soc. Special Prize.
Yield—46 bushels per acre.



Farley Photos, Gnowangerup

H. O. Beck's 50 acres "Yandilla King." No. 8 Zone.
Yield—43 bushels per acre.



Farley Photos, Gnowangerup

J. McDonald's 50 acres "Bena." No. 8 Zone.
Yield—41 bushels per acre.

Mr. C. E. Cockram's crop of the variety Yandilla King, which was awarded first place, was calculated to yield 46 bushels per acre. This constitutes an official record for the State and is a further proof of the suitability of this standard late variety in the Gnowangerup and other districts having similar climatic conditions. It was a well-stooled, healthy, even crop, free from disease but containing a percentage of admixture. Planted at the rate of 60 lbs. of seed per acre, the heads were dense, but could have been better developed. Superphosphate was applied at seeding at the rate of 98 lbs. per acre. The land had been ploughed with a mouldboard plough to a depth of 4 inches during July and August of the previous year. It had been springtyne cultivated in October, again in January, and twice again in April. Subsequently it was seeded with a combined cultivator-drill during the third week in May.

Mr. J. McDonald's crop of the variety Bena, which was placed second, was remarkably even, free from weeds, disease and admixture, and was calculated to yield 41 bushels per acre. Although the yield was not equal to that of Mr. H. O. Beck's crop of Yandilla King it gained points awarded under the other sections. Mr. McDonald's crop had been sown during the first week in June at the rate of 55 lbs. of seed with an application of 102 lbs. of superphosphate per acre.

All the sixteen competitors in this Society's competition obtained excellent calculated yields, the average being approximately 35.5 bushels per acre. The district was fortunate in receiving spring rains which unfortunately were not extended over the whole of the wheat belt. In addition the majority of the crops in the district, being late maturing, derived benefit from the early November rains.

The following shows the rainfall as recorded at Gnowangerup and Pallinup during 1929:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Gnowangerup	33	135	121	32	303	309	123	123	150	79	1,087	282	32	1,722
Pallinup (Clear Hills)	7	136	11	43	306	289	86	81	129	74	965	...	...	...

The methods of cultivation and other details are summarised below:—

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted,	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
Cockram, C. E....	Old land	York Gum and Morrel	July and Aug.	Good	Mould-board	ins. 4	Springtyne cultivated in October, again in January and again twice in April. Drilled with combined cultivator drill	Yandilla King	3rd week May	60	98	Dry	Yes	
McDonald, J. ...	Old land	Salmon, York Gum and Manna Gum	July	Good	Mould-board	3½–4	Harrowed end of August, springtyne cultivated in September and again in February after rain. Harrowed in early March after rain. Springtyne cultivated ahead of combined cultivator drill	Bena	1st week June	55	102	Dry	Yes	
Beck, H. O. ...	Old land	Morrel and Salmon with some White Gum and Sheoak	Late August	Good	Mould-board	3½	Harrowed and scarified in October. Scarified early in May	Yandilla King	End May ...	45	80	Pickled with Bluestone	Re-cleaned	
Formby, R. & Co.	3	Morrel and Salmon	July	Good	Mould-board	3½	Disced 2½in. to 3in. deep in September, and harrowed. Harrowed after rain in January. Scarified immediately prior to seeding. Drilled with combined cultivator-drill	Nabawa	Mid-June ...	52	93	Dry	Yes	
Johnson, Alf ...	3	York Gum, Manna-Gum and some White Gum	August	Good	Mould-board	3	Scarified in September and again just before drilling. Harrowed immediately after drilling	Bena	End May ...	50	90	Dry	Yes	Trace Flag Smut.

CULTURAL DETAILS—*continued.*

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
Chambers, E.	4	Mallee, Morrel and White Gum	August	Good	Mouldboard	in 4	Springtyne cultivated in October, harrowed immediately after. Disced 2in. deep in May. Drilled with combined cultivator-drill with light harrows attached.	Yandilla King	4th week May	45	90	Pickled with formalin	Yes	
Barnard, C. E. ...	7	York Gum, White Gum, and some Morrel	July	Good	Mouldboard	4	Springtyne cultivated in September. Drilled with combined cultivator-drill	Yandilla King	Mid-May ...	35	80	Pickled with formalin	Yes	Trace Takeall.
Baxter, J. ...	3	White Gum and York Gum	July	Very Good	Mouldboard	3	Springtyne cultivated and harrowed in August. Springtyne cultivated just prior to seeding	Major	2nd week May	45	90	Dry	Yes	Traces Takeall and Flying Smut.
Simpson, A.	3	York Gum, White Gum, and Morrel	August	Good	Mouldboard	4	Springtyne cultivated in October and again twice in May prior to seeding	Drof	Mid-May ...	45	90	Dry	No	Traces Takeall and Flying Smut.
White, A. J.	2	Morrel, White Gum and York Gum chiefly	August	Good	Mouldboard	4	Springtyne cultivated twice in spring and once in April. Drilled with combined cultivator-drill	Yandilla King	3rd week May	50	95	Pickled with formalin	No	
Davis, N. L. P....	Old land	Morrel, Salmon and York Gum	July and August	Good	Disc	3½	Disced 2in. deep in September. Springtyne cultivated in October. Harrowed early in November. Springtyne cultivated in May. Drilled with combined cultivator drill	Nabawa	1st fortnight July	45	180	Dry	Yes	

CULTURAL DETAILS.—*continued.*

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
Taylor, C.	1	York Gum, Morrel White Gum and black Mallee	July	Good	Mould-board	ins. 3½	Mouldboard ploughed 2in. deep in October. Springtyne cultivated with wide points and followed by light harrows in February after rain	Yandilla King	Mid May ...	45	114	Dry	Yes	
Lloyd Wood, W.	Old land	Morrel and York Gum	August	Excellent	Mould-board	4	Harrowed in September. Disced 4in. deep at end September and again harrowed. Springtyne cultivated three times before seeding	Nabawa	End June ...	45	120	Dry	Yes	
Whyatt, C. A.	4	Morrel and York Gum	August	Good	Mould-board	4	Springtyne cultivated in February and again in May. Harrowed just after drilling	Nabawa	1st week June	45	120	Pickled with formalin	Yes	Trace Takeall.
Wright, E. H.	3	York Gum and Morrel	July	Good	Mould-board	3½	Disced 2in. deep in September. Springtyne cultivated in April and drilled with combined cultivator drill.	Yandilla King	2nd week May	50	80	Pickled with formalin	Yes	Trace Takeall.
Gillespie, E. A.	Old land	York Gum and Morrel	August	Getting hard	Mould-board	3½	Disced 2in. deep in October. Drilled with combined cultivator-drill	Drof	Mid-June ...	60	90	No	Yes	Trace Takeall.

WICKEPIN AGRICULTURAL SOCIETY.

Seven crops were inspected for the competition conducted by the Wickepin Agricultural Society, two competitors having withdrawn.

The following awards were made:—

WICKEPIN AGRICULTURAL SOCIETY.

Judge: A. S. Wild, B.Sc. (Agric.) Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
G. Hemley ...	Wickepin ...	Gallipoli ...	33	8	8	13	13	75
Hosken Bros. ...	Dorakin ...	Turvey ...	28	9	8	13	13	71
H. W. Willcock	Malvalling ...	Ranee ...	26	9	9	12	13	69
L. C. Dalton ...	Malvalling ...	Free Gallipoli	25	8	8	13	13	67
S. A. Collingswood	Malyalling ...	Gresley ...	22	9	8	13	13	65
Mrs. Munday ...	...	Nabawa ...	23	8	8	13	13	65
Coade & Hewett	...	Ranee ...	23	8	8	13	12	64

The winning crop, of the variety Gallipoli, was that of Mr. G. Hemley and was calculated to yield 33 bushels per acre. It had been planted about the beginning of May at the rate of 58 lbs. of seed per acre, 90 lbs. of superphosphate per acre being applied. This crop was fairly even in growth, contained a small amount of admixture and, except for a few wild oats and drake plants, was fairly free of weed growth.

Messrs. Hosken Bros.' crop of the variety Turvey was placed second, the calculated yield for this crop being 28 bushels per acre. The crop had been planted during the second week of April at the rate of 65 lbs. of seed per acre, together with an application of 112 lbs. per acre of superphosphate.

The rainfall as recorded at Wickepin during the year was as follows:—

—	Jan.	Feb.	Mar.	Apl.	Useful Rains.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Wickepin	38	50	14	59	298	464	163	139	107	44	1,215	217	15	1,677

The methods of cultivation employed by the competitors are as hereunder:—

CULTURAL DETAILS.

...titor.	No. years cropped.	Timber	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
...ley, G. ...	2	Salmon, York Gum, and Jam	June and July	Good	Mould-board	in. 4	Springtyne cultivated end of Sept. Drilled with combined cultivator-drill with light drag harrows attached	Gallipoli	End April ...	58	90	Dry	Re-cleaned	Trace, Flying Smut.
...en Bros. ...	4	Jam, White Gum and Sheoak	Late July	Good	Mould-board	4	Springtyne cultivated in Sept. and drilled with combined cultivator-drill	Turvey	2nd week April	65	112	Pickled with Formalin	Yes	Traces, Take-all and Flying Smut
...ock, H. W.	5	Salmon and Jam	Late July	Good	Mould-board	4	Disced 2in. deep in Sept., and again before seeding. Drilled with combined cultivator-drill with light drag harrows attached.	Ranee	Mid May ...	60	90	Dry	Re-cleaned	
...n, L. C. ...	Old land	Salmon-Gum running to York Gum and Jam	July	Good	Mould-board	4	Disced 2in. deep in Sept., and again before seeding	Free Gallipoli	1st week May...	65	90	Dry	Yes	Trace, Take-all.
...gwood, S.	1	Salmon and White Gum	July	Good	Disc	...	Springtyne cultivated late Sept. Drilled with combined cultivator-drill	Gresley	2nd week May	60	90	Dry	Yes	Traces, Take-all and Flying Smut.
...lay, Mrs. ...	Old land	Morrel and Salmon	Aug.	...	Mould-board	3–4	Drilled with combined cultivator-drill	Nabawa	1st week May	45	110	Dry	Yes	Trace, Take-all.
...e & Hewett	about 10	Salmon, Morrel, and Jam	July and Aug.	...	Mould-board	3½	Scarified late in Sep. Portion disced 2in. deep early in Mar. and whole scarified before drilling. Drilling followed by light harrows	Ranee	End April ...	48	100	Dry	Yes	Traces, Take-all and Flying Smut.

ROYAL AGRICULTURAL SOCIETY.

The four competitors whose entries were received direct by the Royal Agricultural Society were located in the Broomehill, County Peak, South Caroling and Beverley districts respectively.

The awards were as hereunder:—

Competitor.	Variety.	Yield. 50 points.	Freedom from—			Evenness of growth. 15 points.	Total. 100.
			Weeds. 10 points.	Disease. 10 points.	Admixture. 15 points.		
Roberts, I. B, Broomehill ...	Gresley ...	38	8	8	13	14	81
McLean, John, County Peak	Nabawa ...	34	8	9	13	14	78
Richards, T., Sth. Caroling ...	do. ...	30	8	9	14	14	75
Smith, H. D., Beverley ...	do. ...	21	7	9	13	12	62

The crop of Mr. I. B. Roberts, which tied for fourth place in the competition for Zone 8, was of a variety alleged to be Gresley. It secured 81 points out of the possible 100, the yield being calculated at 38 bushels per acre. The fallow on which the crop was grown had been ploughed to a depth of five inches with a mouldboard plough during the June and July of the previous year. It had been harrowed in August, springtyne cultivated in September, and again in March. The crop was planted during the second week in May with a combined cultivator-drill and harrowed immediately after. Seed was planted at the rate of 70 lbs. per acre and superphosphate applied at the rate of 112 lbs. per acre.

Unfortunately the seed had not been treated for the prevention of Ball Smut and consequently a trace of this disease was present.

The following table shows the rainfalls as recorded at the official stations nearest to the competitors:—

--	Jan.	Feb.	Mar.	Apl.	Useful Rains.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total			
Broomehill	8	136	12	47	369	403	174	144	149	93	1,332	422	34	1,991
County Peak (Bally Bally)	28	57	61	13	218	382	203	126	84	62	1075	145	...	1,379
Sth. Caroling (Quairading)	10	94	120	5	300	349	185	101	49	21	1,005	135	17	1,386
Beverley	54	114	45	21	294	415	194	155	62	24	1.144	193	9	1,580

The cropping details of the various crops are as hereunder:—

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of seed.	Rate of super.	Treated.	Graded.	Disease.
Roberts, I. B. ...	Old land	York Gum and Jam	June and July	Excellent	Mouldboard	in. 5	Harrowed in Aug. Springtyne cultivated in Sept., and again in Mar. Drilled with combined cultivator-drill and harrowed	Gresley ?	2nd week May	70	112	No	Yes	Traces, Flying Smut, and Ball Smut.
McLean, John ...	Old land	Salmon and Morrel	Aug.	Fair	Mouldboard	4	Springtyne cultivated twice in Spring and once in autumn. Disced 2in. deep just before seeding. Harrowed just after drilling	Nabawa	10th June ...	65	120	Dry	Yes	
Richards, T. ...	Old land	Salmon, Gimlet, and Morrel	July	Good	Mouldboard	4-4½	Springtyne cultivated twice in Spring and twice in Autumn. Drilled with a combined cultivator drill	Nabawa	End May ...	49	130	Dry	Yes	
Smith, H. D. ...	Old land	Jam and York Gum	July	Good	Mouldboard	4	Springtyne cultivated in Spring and again in Autumn. Drilled with combined cultivator-drill with light drag harrows attached	Nabawa	1st week May	60	76	Dry	Yes	

ZONE 9.

Judge—I. THOMAS, Superintendent of Wheat Farms.

In previous years no competitors were forthcoming from districts located in this zone because the climatic and other conditions are very dissimilar to other districts with which they would have competed, and subsequently they did not take an active interest in the competition.

With the creation of a new zone embracing the Esperance and the Ravensthorpe areas, keen friendly rivalry now exists. This is commendable and will do much to standardise and improve the methods adopted.

The Ravensthorpe Agricultural Society conducted a local competition, but as this is not an affiliated Society it was necessary for all competitors participating in the Zone competition from this area to enter direct with the Royal Agricultural Society. The Southern Mallee Agricultural Society being affiliated, the winners of the local crop competition automatically became eligible to compete for the Zone championship awards.

The awards made are as follow:—

SOUTHERN MALLEE AGRICULTURAL SOCIETY.

Judge: I. Thomas, Superintendent of Wheat Farms.

Competitor.	Address.	Variety.	Yield. 5 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total, 100 pts.
T. Haywood ..	E. Dowak	Nabawa ...	19	9	9	12	14	63
H. S. Sharpe ...	Treslove ...	Nabawa ...	17	9	9	13	14	62
L. Machen ...	Circle Valley	Nabawa ...	18	8	8	13	12	59
J. P. Shaw ...	Salmon Gums	Yandilla King	16	9	9	12	12	58
N. McCrea ...	Salmon Gums East	Nabawa ...	15	9	9	12	12	57
E. Erdman ...	Red Lake ...	Nabawa ...	13	9	9	14	11	56
L Webster ...	Dowak ...	Gallipoli ...	14	9	9	11	12	55
J. McCosh ...	Kumarl ...	Nabawa ...	14	9	9	11	12	55
R. B. Johns ...	Grass Patch	Gluyas Late	14	8	8	12	12	54
C. Flintham ...	Scaddan ...	Canberra ...	11	8	9	14	11	53
A. Sioldas ...	Dowak ...	Nabawa ...	11	8	9	12	12	52

It will be noticed that the competitors were well scattered throughout the Esperance wheat area from Kumarl in the North to Treslove and Scaddan in the South. It will also be noticed that the midseason varieties were most prominent. In view of the climatic conditions which were experienced, particularly towards the latter part of the growing season, this is somewhat different from what would be expected, and it would appear, when the dates of planting are perused, that the time of planting is an important factor. In this district, where the rainfall varies greatly in the North from that in the South, the settlers would be well advised to pay particular attention to the times of planting the different maturing varieties.

Another factor to which attention should be drawn is the treatment of the fallowed land. It was very noticeable when travelling through the district that many of the fallows were too "flat," the mulch too shallow and inclined to set, and it appeared to the writer that the harrows had been used where it would have been preferable to have had the springtyne cultivator. The soil (not the Kopi) in this district, is of such a nature that it becomes fine too readily. Consequently the treatment of the ploughed land should be such as will tend to keep the mulch (about 2 inches deep) in a rough and loose condition, particularly during the early months of the fallowed period.

T. Haywood's Winning Crop of "Nabawa", No. 9 Zone.
Calculated yield—19 bushels.

The rainfall as recorded at the different centres is hereunder:—

	Jan.	Feb.	Mar.	Apl.	Useful Rains.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Salmon Gums	108	70	56	26	117	201	135	133	21	43	650	184	33	1,127
Grass Patch	120	97	94	15	248	239	139	193	13	63	895	241	71	1,533
Dowak ...	...	...	74	14	131	217	130	88	13	38	617	153	53	911
Scaddan	119	64	69	43	218	293	133	87	47	55	833	283	116	1,527

The cultural details of the competing crops are summarised hereunder:—

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Treated.	Graded.	Disease.
Haywood, T. ...	1	Gimlet, Silver Mallee and Tea-tree Scrub	August	Good	Disc	ins. 3–4	*Nil*	Nabawa	Last week April	45	75	Dry	Yes	Trace of Ball Smut.
Sharp, H. S. ...	1	Light Mallee and Scrub	June-July	Good	Disc	3–4	Cross disced in March	Nabawa	1st week May	45	80	Dry	No	
Machen, L. D. ...	3	Salmon Gums and Heavy Mallee	June	Good	Disc	4½	Disced in September. Harrowed prior to seeding	Nabawa	Early May ...	45	90	Dry	No	Trace of Take-all and Loose Smut.
Shaw, J. F. ...	1	Black Mallee, Broom Bush, Yorrell	July-August	Good	Disc	4	Harrowed in March after rain. Spring-tyne cultivated prior to seeding	Yandilla King	Last week April	45	90	Dry	Yes	
McCrea, N. J. ...	1	Silver Gum and Gimlet, Mallee, Tea-tree Scrub	June-July	Good	Disc	3	Cross disced March and April	Nabawa	2nd and 3rd weeks May	45	93	Dry	Yes	Trace Loose Smut.
Erdman, E. ...	1	Stunted Mallee	June	Good	Disc	4	Cross disced in September. Harrowed after rain in January. Scrub raked in February. Spring-tyne cultivated prior to drilling	Nabawa	1st week May	45	90	Dry	Yes	
Webster, J. L. ...	1	Mallee, Whip Stick, Gimlet, Broombush	October	Good	Rigid-tyne	3	Rigid-tyne cultivated in September. Harrowed in March and again in April	Gallipoli	3rd week April	35	80	Dry	Yes	

CULTURAL DETAILS—*continued.*

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of land.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Treated.	Graded.	Disease
McCosh, J. ...	2	Light Gimlet and Salmon Gum	August	Hard	Disc	ins. 3	Springtyne cultivated and harrowed early April	Nabawa	End of April	45	85	Dry	Yes	
Johns, B. B. ...	2	Mallee and Scrub	June-July	Hard	Mouldboard	4½	Rigid-tyne cultivated after ploughing. Harrowed during summer and rigid-tyne cultivated before seeding	Gluyas Late	Early April ...	60	60/90	Dry	No	Trace of Take-all.
Flintham, A. ...	1	Mallee ...	May, 1928	Good	Disc	3	Re-ploughed October and again prior to seeding	Canberra	2nd week May	48	90	Bluestone	Yes	
Sioldas, A. ...	1	Merrit, Silver Bark, Mallee and Tea-tree Scrub	August	Patches hard	Disc	3–3½	Harrowed with heavy harrows after rain January. Planted with combined cultivator-drill	Nabawa	1st week May	45	90	Dry	No	

PHILLIPS RIVER AGRICULTURAL SOCIETY.

This Society conducted a local competition, the area of each competing plot being 25 acres. This included those competitors who also competed in the Zone competition and whose area was, of necessity, 50 acres.

The awards made are as follows:—

PHILLIPS RIVER AGRICULTURAL SOCIETY.

Judge—I. Thomas, Superintendent of Wheat Farms.

Competitor.	District.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 pts.
Campbell, J. ...	Ravensthorpe	Yandilla King	17	7	8	13	12	57
Reynolds, W. E.	Ravensthorpe	Nabawa ...	16	7	8	12	12	55
Barrett Bros. ...	Ravensthorpe	Nabawa ...	11	9	9	14	11	54
Chapman, I. J.	Kulíba ...	Yandilla King	13	9	9	11	12	54
Bennett, E. T.	Kuliba ...	Lena ...	15	7	8	10	12	52
Smith and Sons	Kuliba ...	Nabawa ...	13	9	6	12	11	51

It will be noted that in this competition no crops of early maturing varieties were inspected.

It was somewhat surprising that the winning crop (located as it was in the Northern end of the district) was of the late variety Yandilla King. This crop, although it had suffered somewhat owing to insufficient rain, had not suffered nearly to the same extent as earlier maturing crops in the locality. It is quite evident that factors other than that of the variety accounted for this.

The land on which the winning crop was grown had been prepared by being mouldboard ploughed early in August to a depth of 3 inches. It was subsequently springtyne cultivated at the end of September and early October, again after rain in January and before seeding, which took place the first week in May. The seed was sown at the rate of 45 lbs. per acre, and superphosphate was applied at the rate of 107 lbs. per acre.

The crop of Nabawa which was placed second was well grown for the main part, but it was apparent that it had also suffered owing to the scanty seasonal rains. It was planted with 60 lbs. of seed with an application of 60 lbs. of superphosphate during the first week in June.

Like the Esperance area, the rainfall differs considerably in the Southern portion of the district from that in the Northern end, and consequently particular attention should be given to the varieties and the time of planting them. In this connection, the planting of portion of the area in the Northern area with earlier varieties is recommended.

The rainfall as recorded at Ravensthorpe is set out in the table below:—

—	Jan.	Feb.	Mar.	Apl.	Useful Rains.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Ravensthorpe	120	87	84	34	223	188	106	94	72	69	752	227	75	1,379

The following are the cultural details of the competing crops:—

CULTURAL DETAILS.

Competitor.	No. years cropped.	Timber.	When fallowed.	Condition of Land.	Implement.	Depth.	Subsequent cultivations.	Variety.	Planted.	Rate of Seed.	Rate of Super.	Treated.	Graded.	Disease.
						ins.								
Campbell, J. ...	5	Jam and Mallee	August	Good	Mould-board	3	Springtyne cultivated end September and early October and in January after rain and before seeding	Yandilla King	1st week May	45	107	Formalin	Yes	Trace of Take-all.
Reynolds, W. E.	3	Mallee and broom Bush	July	Good	Mould-board	4	Springtyne cultivated in August, again September, and again prior to seeding	Nabawa	1st week June	45	60	Dry	No	Trace of Take-all.
Barrett Bros. ...	1	Salmon Gum, Gimlet and Mallee	July	Good	Disc	3	Cross disced September and October, again early March before rain. Springtyne cultivated before seeding	Nabawa	Middle May ...	56	83	Dry	Yes	
Chapman, I. J.	1	Scrub plain	August	Good	Disc	3	Cross disced in February	Yandilla King	2nd week May	60	90	Dry	Yes	
Bennett, E. T....	Old land	Sandy river flat Yate and Xmas tree	November	Hard	Disc	3	Skim plough prior to seeding	Bena	Late May ...	45	120	Dry	Yes	Trace of Rust.
Smith & Sons ...	1	Scrub plain	July	Good	Disc	3	Cross disced in March	Nabawa	Early June ...	54	90	Dry	Yes	Portion bad with bad Smut.

ROYAL AGRICULTURAL SOCIETY ZONE CHAMPIONSHIP AWARDS.

The entrants for these championship prizes are the first and second prize winners of the district Agricultural Societies' competitions, and also those competitors who entered direct with the Royal Agricultural Society. Some societies, however, did not comply with the conditions, and therefore were not eligible to compete.

The competitors in the different zones, together with the points allotted, are shown in the table hereunder:—

REPRESENTATIVES FROM DISTRICT AGRICULTURAL SOCIETYS' COMPETITIONS AND ENTRIES RECEIVED DIRECT BY ROYAL AGRICULTURAL SOCIETY.

Competitor.	Society.	Variety.	Yield. 50 pts	Freedom from Weeds. 10 pts.	Freedom from Disease. 10 pts.	Freedom from Admixture. 15 pts.	Evenness of Growth. 15 pts.	Total. 100 pts.
ZONE 1.—Judge: F. L. Shier, B.Sc. (Agric.), Agricultural Adviser.								
Lucas, F. ...	Royal ...	Nabawa ...	27	9	9	14	13	72
Forrester, J. K.	Royal ...	Lena ...	26	9	9	14	13	71
Robertson, R. ...	Royal ...	Merredin ...	25	8	9	14	13	69
Bowman, J. ...	Royal ...	Merredin ...	26	8	7	14	13	68
Johnson, I. ...	Royal ...	Nabawa ...	24	8	9	14	13	68
Cu[illegible]ing Bros. ...	Royal ...	Nabawa ...	23	8	8	13	13	65
Green Bros. ...	Royal ...	Merredin ...	22	8	8	14	13	65
ZONE 2.—Judge: F. L. Shier, B.Sc. (Agric.), Agricultural Adviser.								
Bradford Bros.	Dalwallinu ...	Gluyas Early	29	9	9	14	13	74
Moore, T. ...	Royal ...	Nabawa ...	27	9	9	14	14	73
Bellby A. H. ...	Dalwallinu ...	Gluyas Early	26	9	9	14	14	72
ZONE 3.—Judge: A. S. Wild, B.Sc. (Agric.), Agricultural Adviser.								
Armstrong, W. N.	Wongan Hills	Nabawa ...	30	9	9	13	14	75
Fowler, G. F. ...	Wongan Hills	Clubhead ...	31	8	9	13	13	74
Williams, G. J....	Dowerin ...	Gluyas Early	26	8	8	13	14	69
Cosh, E. C. ...	Dowerin ...	Nabawa ...	24	9	9	13	13	68
ZONE 4.—Judge: R. P. Roberts, B.Sc. (Agric.), Agricultural Adviser.								
Fitzpatrick, R. C.	Nungarin ...	Gluyas Early	25	9	8	14	13	69
Young, G. T. ...	Nungarin ...	Gluyas Early	22	8	8	14	13	65
Collins, M. C. ...	Mt. Marshall	Nabawa ...	22	8	9	12	12	63
Hopwood, B. W. G.	Mt. Marshall	Gluyas Early	18	9	8	13	13	61
ZONE 5.—Judge: G. L. Throssell, Dip. (Agric.), Agricultural Adviser.								
Cook, W. ...	Merredin ...	Nabawa ...	26	9	9	13	14	71
Teasdale, H. W.	Merredin ...	Nabawa ...	25	9	9	14	13	70
Prowse Bros. ...	Doodlakine-Baandee	Nabawa ...	22	9	9	14	13	67
Reynolds, M. H.	Royal ...	Gresley ...	20	9	9	14	13	65
Prowse, E. W.	Doodlakine-Baandee	Gluyas Early	20	8	8	14	13	63
ZONE 7.—Judge: J. H. Langfield, Manager, Experiment Farm, Merredin.								
Henderson, J. H.	Kulin ...	Queen Fan ...	28	9	9	13	14	73
Haddon, O. F. ...	Lake Grace ...	Nabawa ...	27	8	9	14	13	71
Trotter, A. W. ...	Kulin ...	Lena ...	26	9	9	14	13	71
Darby, A. H. ...	Lake Grace ...	Gluyas Early	26	8	9	14	13	70
ZONE 8.—Judge: A. S. Wild, B.Sc. (Agric.), Agricultural Adviser								
Cockram, C. E.	Gnowangerup	Yandilla King	46	9	9	13	14	91
McDonald, J. ...	Gnowangerup	Lena ...	41	9	9	14	14	87
Roberts, I. B. ...	Royal ...	Gresley ? ...	38	8	8	13	14	81
McLean, J. ...	Royal ...	Nabawa ...	34	8	9	13	14	78
Richards, T. ...	Royal ...	Nabawa ...	30	8	9	14	14	75
Hemley, G. ...	Wickepin ...	Gallipoli ...	33	8	8	13	13	75
Hosken Bros. ...	Wickepin ...	Turvey ...	28	9	8	13	13	71
Smith, H. D. ...	Royal ...	Nabawa ...	21	7	9	13	12	62
ZONE 9.—Judge: I. Thomas, Superintendent of Wheat Farms.								
Haywood, T. ...	Southern Mallee	Nabawa ...	19	9	9	12	14	63
Sharpe, H. S. ...	Southern Mallee	Nabawa ...	17	9	9	13	14	62
Campbell, J. ...	Royal ...	Yandilla King	17	7	8	13	12	57
Reynolds, W. F.	Royal ...	Nabawa ...	16	7	8	12	12	55
Chapman, I. J.	Royal ...	Yandilla King	13	9	9	11	12	54
Smith & Sons ...	Royal ...	Nabawa ...	13	9	6	12	11	51

LEADING COMPETITORS FOR ROYAL AGRICULTURAL SOCIETY'S SPECIAL PRIZE FOR HIGHEST YIELD IN ANY ZONE.

Zone.	Competitor.	Address.	Variety.	Calculated Yield.
				bush.
8	C. E. Cockram	Pallinup	Yandilla King	46
8	H. O. Beck	Gnowangerup	Yandilla King	43
8	J. McDonald	Gnowangerup	Bena	41
8	R. Fornaby & Co.	Gnowangerup	Nabawa	38
8	I. B. Roberts	Broomehill	Gresley	38
8	A. Johnson	Gnowangerup	Bena	36
8	C. E. Barnard	Pallinup	Yandilla King	35
8	J. Baxter	Pallinup	Major	35
8	A. Simpson	Pallinup	Drof	35
8	N. L. P. Davis	Pallinup	Nabawa	35
8	E. Chambers	Pallinup	Yandilla King	34
8	J. McLean	Beverley	Nabawa	34
8	G. Henley	Wickepin	Gallipoli	33
8	A. J. White	Pallinup	Yandilla King	32
8	C. Taylor	Pallinup	Yandilla King	32
8	W. Lloyd Wood	Pallinup	Nabawa	32
8	C. A. Whyatt	Pallinup	Nabawa	32
8	E. H. Wright	Pallinup	Yandilla Knig	31
3	G. F. Fowler	Wongan Hills	Clubhead	31
3	Mt. Rupert Co.	Wongan Hills	Cresley	30
3	W. N. Armstrong	Wongan Hills	Nabawa	30
3	T. Richards	South Caroling	Nabawa	30
2	Bradford Bros.	Ballidu	Gluyas Early	29
8	E. A. Gillespie	Pallinup	Drof	29
7	J. H. Henderson	Kulin	Queen Fan	28
7	Bailey & Russell	Kulin	Hard Federation	28
3	A. E. Parker	Wongan Hills	Nabawa	28
8	Hosken Bros.	Doradin	Turvey	28
3	Smith & Nunn	Wongan Hills	Nabawa	27
1	F. Lucas	Carnamah	Nabawa	27
2	T. Moore	Indarra	Nabawa	27
7	G. F. Haddon	Lake Grace	Nabawa	27
7	A. W. Trotter	Kulin	Bena	26
7	F. S. Freebairn	Kulin	Queen Fan	26
7	R. Nicholls	Kulin	Merredin	26
1	J. K. Forrester	Carnamah	Bena	26
7	A. H. Darcy	Lake Grace	Gluyas Early	26
1	J. Bowman	Carnamah	Merredin	26
2	A. H. Bellby	Ballidu	Gluyas Early	26
3	G. J. Williams	Hindmarsh	Gluyas Early	26
8	H. W. Willcock	Malvalling	Ranee	26
5	W. Cook	South Walgoolan	Nabawa	26
1	R. Robertson	Carnamah	Merredin	[illegible]
5	H. W. Teasdale	Totadgin	Nabawa	25
2	F. C. Locke	Dalwallinu	Merredin	25
2	H. Locke	Pithara	Golden King	25
4	R. C. Fitzpatrick	Nungarin	Gluyas Early	25
3	J. H. Ackland	Wongan Hills	Nabawa	25
8	L. C. Dalton	Malvalling	Free Gallipoli	25
7	H. Bishop	Lake Grace	Nabawa	25

OBJECTS OF THE COMPETITION.

The improvement of the standard wheat-farming methods practised throughout the Wheat Belt is the ultimate objective of those responsible for the conducting of the wheat crop competitions. A spirit of friendly rivalry is engendered and competitors and others set themselves to follow those more successful than themselves. The methods of successful farmers in all districts are tabulated for inspection, the good farmers of the State receive recognition of their ability, and consequently a standard of practical wheat farming is established. It is demonstrated that where recommended methods are employed, reasonable success follows. The conducting of crop competitions is also a means whereby the farmer is brought into closer contact with the officers of the Department of Agriculture.

THE SEASON.

The season under review was the cause of much anxiety.

The seasonal rains commenced early in May. This enabled the crops to be planted under ideal conditions. Favourable conditions continued until the end of June. During July the rainfall was scanty, but no alarm was felt. The lack of rain in August, however, gave cause for anxiety. At the end of that month the crops were showing signs of distress, and as the adverse conditions continued during September, the position was viewed most seriously, and it was feared that the season which was most promising during the early part would end with disastrous results. In October belated rains were experienced in some parts of the wheat belt. In the early districts where this rain fell it was too late to be of any use. In the Southern and other late districts further late rains were experienced, and in consequence the yields obtained exceeded those of last year.

Despite the adverse conditions which prevailed throughout portion of the growing period, the results in all districts are excellent, and would again indicate that the State average of 10 to 11 bushels can be considerably increased when sound farming methods are practised.

ENTRIES.

The total number of competing crops eligible to compete for the Zone Championship Awards was 143, compared with 114 the previous year and 160 in 1927. This increase in a year of scanty rainfall indicates that the competition is not lacking in interest.

Entries were received from twelve district Agricultural Societies, whilst nineteen entries were received direct by the Royal Agricultural Society.

In addition, six societies conducted local competitions. These included 66 competitors not eligible to compete for the Royal Agricultural Society's Zone prizes. Thus the total number of competing crops inspected in all competitions was 209 against 145 of the previous year.

FALLOWING.

All the competitors ploughed (fallowed) their land for their competition plot during the months of June, July or August of the previous year. In this connection it has been demonstrated by experiments that a higher yield may be expected from the land when ploughed early in the fallowing season than when ploughed later. From an experiment conducted at the Merredin Experiment Farm during the past five years, the average results show that an increase of four bushels sixteen pounds per acre was obtained from the plots fallowed in June as compared with the plots ploughed in August.

The average depth of the initial ploughing was from three to four inches, both disc and mouldboard ploughs being used for this operation. The advantage of using either type of implement is determined by the type and condition of soil to be ploughed. Whether the disc or the mouldboard plough be selected, it is essential that the work be done thoroughly.

It is particularly pleasing to note that many of the competitors are appreciative of the value of sheep to assist in controlling weed growth on the fallowed land.

Some of the reasons for fallowing are the conservation of moisture, the destruction of weed growth, the enrichment of the soil's supply of plant food, the control of disease, and the preparation of a suitable seed bed. Since the majority of the competitors are farming with these objects in view, it is not surprising to find a striking similarity between the methods adopted for the preparation of the seed bed. The springtyne cultivator was the implement chiefly used for the cultivation subsequent to the initial ploughing. A disc implement, however, was favoured for cultivations where the land was hard or weedy.

DISEASES.

Although reliable preventative methods are available for the prevention of Ball Smut, there are still some farmers who are not successful in entirely preventing this disease. The most popular method of treating the wheat is the dry method with copper carbonate. When correctly applied, this method is effective in preventing the disease. It has the additional advantage that the seed can be treated immediately after harvest, and when treated the copper carbonate acts as a preventative against vermin.

Although the majority of the competitors adopted the dry method, all of those who used it were not successful. The highly satisfactory results which many have obtained with this treatment indicate that failure with it is due to some defect in the methods of application. Effective results can only be obtained when the seed is dusted thoroughly with the powder. Those working the machines for treating the seed are sometimes inclined to treat the work as a "rush" job, and in consequence the grain is not covered as thoroughly as it should be.

The disease "Flag Smut" was noticed in a number of crops inspected. This disease is becoming rather prevalent, and, unless steps are taken to control it, will become most serious. It is more difficult to control than "Ball Smut," because it is usually transmitted by soil infection and not by the seed. The foliage of infected plants is carried by the wind, and consequently the soil of previously clean fields becomes infected. As a precaution it is advisable to treat the seed with dry copper carbonate, but if the seed is planted on infected land it is not effective. Some varieties are highly resistant to this disease. It is fortunate that the standard midseason variety "Nabawa" is included in these, as is also the late maturing variety, "Yandilla King." Unfortunately the standard early variety, "Gluyas Early," which has proved such an excellent variety suitable for the greater part of the wheat belt, particularly in the early and drier districts, is very susceptible as are also other favoured early maturing varieties, including "Canberra" and "Merredin." The varieties "Carrabin" and "Geeralying," however, both early maturing, are highly resistant and are recommended for planting on infected areas.

The cutting of infected crops for hay and feeding to stock on the farm should not be practised as it does not assist to control the disease, as is generally supposed, but helps to spread the disease over the farm.

As an adidtional precaution, and particularly when resistant varieties are not available or are unsuitable for the special climatic conditions, the land for the next crop should be fallowed in the early winter months—

June and July—and all weed growth which may appear on the fallowed land destroyed either by sheep or by cultivation. It is also advisable, where possible, to grow a crop of oats between the two crops of wheat.

Summarised, the method of control recommended is as follows:—

1. Fallow, and fallow early.
2. Destroy all weed growth on the fallow.
3. Plant resistant varieties.
4. Plant as late as is safe to plant in the sowing season.
5. Treat the seed as for "Ball Smut."
6. Discontinue feeding to stock hay from infected areas.
7. Include a crop of oats in the cropping rotation of the farm.
8. Burn the stubble of infected crops.

Some crops were also attacked by the disease "Take-all." Unfortunately no variety, as yet, is known to be resistant to this disease, and its control, therefore, depends entirely on the farming practice adopted. Suitable methods for the control of "Take-all" are similar to those already recommended for the control of "Flag Smut." In addition, planting as late as is safe in the sowing season is beneficial. Early fallowing and late sowing should, therefore, be the methods adopted to control this disease.

The occurrence of Flying or Loose Smut of wheat is more difficult to prevent. Fortunately, it is unusual for crops to be seriously affected by this disease. The treatment of the seed for the control of Flying Smut of wheat cannot be economically undertaken. A reasonable control, however, is to be expected by planting clean seed from clean crops.

The disease "Septoria" is liable to occur in crops of early varieties of wheat planted too early. Under these conditions there is a tendency for the plants to make rank and flaggy growth, and as a result they become more susceptible to infection by the fungus. The control of "Septoria" consists of seasonable planting and the practice of the clean farming methods recommended for the control of "Flag Smut" and "Take-all." The inclusion of an oats crop in the rotation is also beneficial.

VARIETIES.

As in previous years the most popular variety was Nabawa, 74 of the 209 competing crops being planted with this standard midseason variety. Forty-six competitors planted the standard early variety Gluyas Early. The previous year (1928), of the total number of competitors, 114, thirteen competitors planted this variety. To some extent this increase is due to the inclusion in this report of the details of competitions conducted in the more Eastern districts. The suitability of Gluyas Early for districts of scanty rainfall has been demonstrated over a period of years.

Twenty-one competitors planted the early maturing variety Merredin.

The variety Gluclub was planted by eleven competitors, all of whom were located in the Bruce Rock area.

Eleven competitors also planted the standard late variety Yandilla King. A crop of this variety again secured the Royal Agricultural Society's special prize for the highest yield in any zone.

Eight crops were planted with the variety Bena, five with Gresley and four with Gallipoli. The varieties Canberra, Hard Federation, Ford and Queen Fan were each represented by three competitors. Two competing crops were planted with variety Waratah and the same number with Drof and Ranee respectively.

The remaining varieties represented in the competition, viz., Gluyas Late, Golden King, Clubhead, Dollar, Toby's Tusk, Pusa, Boolaroo, Major and Turvey were each planted by one competitor only.

TIME OF SEEDING.

The period during which the various crops were planted extended over the months of April, May and June.

The following table shows the time at which the crops in the various zones were shown, the figures referring to those on fallowed land only.

Zone.	Number of Competitors.	Number of Competitors planting during—					
		April.	First fortnight May.	Middle of May.	Last fortnight in May	June.	Unknown.
1	7	...	3	2	2	...	...
2	15	5	4	5	...	1	...
3	35	6	18	2	6	2	1
4	19	9	7	...	2	1	...
5	38	9	17	7	5	...	...
7	30	5	8	11	3	2	1
8	27	3	7	4	6	7	...
9	17	5	7	2	1	2	...
Totals	188	42	71	33	25	15	2

One hundred and twenty-nine of the competitors planted during the month of May, 42 in April and 15 in June. It has been demonstrated in experiments that when it is necessary, owing to the area to be sown, to seed outside the month of May, it is better to plant suitable varieties in April rather than to extend the period of planting into June.

RATES OF SEEDING.

The quantities of seed sown varied from 20 lbs. to 70 lbs. per acre. The table hereunder shows the rates employed in each zone, no reference being made to the crops grown on non-fallowed land:—

Zone.	Number of Competitors.	Number of Competitors using—				
		Under 45lbs. per acre.	45lbs. per acre.	45lbs. to 60lbs. per acre.	Over 60lbs. per acre.	Unknown.
1	7	...	1	6	...	...
2	15	...	1	14	...	...
3	35	1	13	20	...	1
4	19	10	1	7	1	...
5	38	7	14	16	1	...
7	30	2	12	15	...	1
8	27	1	9	14	3	...
9	17	1	11	5	...	...
	188	22	62	97	5	2

The majority of the competitors planted from 45 lbs. to 60 lbs. per acre. Experimental results indicate that, while the yield is not decreased by heavier rate of seeding, no advantage is gained by increasing the amount over 45 lbs. per acre.

FERTILISERS.

All the competitors applied superphosphate, the average rate on all competition crops on fallowed land being 94 lbs. per acre. The rates applied varied from 50 lbs. up to 180 lbs. per acre.

The table below shows the quantities and average amounts used in each zone, the averages being compared with those of the previous two years.

Zone.	Number of Competitors.	Number of Competitors using—					Average rates in lbs. per acre.		
		Under 80lbs. per acre.	80 to 99lbs. per acre.	100 to 119lbs. per acre.	Over 120lbs. per acre.	Unknown.	1929.	1928.	1927.
1	7	...	2	4	1	...	107	108	123
2	15	7	5	3	...	...	80	86	69
3	35	4	15	9	6	1	97	102	90
4	19	6	12	1	...	...	82	91	81
5	38	7	31	6	...	...	92	91	86
7	30	3	10	10	6	1	102	92	85
8	27	1	15	6	5	...	101	102	87
9	17	3	12	1	1	...	88	...	...
	188	25	102	40	19	2	94	90	86

The average rate applied per acre by all competitors was 94 lbs. per acre, this being an increase over the average rate for the previous year.

Experiments at the various experiment farms have shown that increased yields are obtained when the heavier dressings of superphosphate up to 150 lbs. per acre are applied.

YIELDS.

The table below shows the comparison between the yields for the 1929-30 season and the previous two seasons.

Zone.	Number of Competitors.	Average Calculated Yields.		
		1929.	1928.	1927.
1	7	24·7	29·0	28·0
2	15	22·5	19·3	22·4
3	35	23·4	21·3	25·6
4	19	18·2	18·3	29·2
5	38	21·9	20·4	26·2
7	30	22·0	23·0	25·6
8	27	32·2	31·1	32·0
9	17	14·5	...	...
	188	20·7	22·5	26·9

The average calculated yield for all competing crops on fallowed land inspected this year was 20.7 bushels per acre; that for 1928, 22.5 bushels; for 1927, 26.9 bushels; and for 1926, 24.5 bushels per acre.

The crops competing for the Royal Agricultural Society's awards gave an average calculated yield of 23.3 bushels per acre against the 22.5 bushels of the previous year.

This is sufficient to show that even a year of adverse climatic conditions reasonable yields can be obtained when advocated and proved methods of agriculture are practised.

BLACKLEG IN CATTLE IN WESTERN AUSTRALIA.

A. F. FLOOD, M.R.C.V.S., Dip. Ag.

Blackleg or Symptomatic Anthrax is an acute infectious disease which occurs amongst young cattle and sheep grazing on old, rich, low-lying permanent pastures. The disease is due to a germ, the Bacillus Chauveoi, which lives in the soil. This germ is about 1/250th of a millimetre long by 1/1000th of a millimetre broad.

Blackleg has occurred in West Australian dairy cattle in the South-West coastal swamps and river flats. It usually occurs during April and May in dry years. Certain seasons appear to be favourable to the development of the bacillus, which multiplies in a favourable environment. The disease appears and disappears suddenly; several years may intervene between outbreaks.

Symptoms (or signs) of the disease in affected stock are usually acute and lead to death in 48 hours or less. First there is an elevation of temperature to 107 deg. F., loss of appetite, dullness, lameness usually develops in one leg. A fore or hind leg may be attacked or the submaxillary space under and between the branches of the lower jaw. The last situation is uncommon. Usually lameness occurs and on examination of the affected leg an emphysematous (gas distended) swelling may be found on the shoulder if in the foreleg or on the quarter or hip in the hind leg. The skin over the swellings is parchment like and when pressed gas can be felt in the tissues underneath. The swellings are usually about the size of a football. If cut into, the muscles appear dry, porous, and black. and in between the muscles a frothy bloody serum accumulates. The affected muscles have an odour of sour butter.

The carcase swells up quickly after death and blood sometimes trickles from the nostrils and anus.

Examination of the carcase in cases occurring in this State revealed, in addition to muscle lesions, pale-coloured mucous membranes, and discharge of blood from nostrils and anus. The lungs and pleura appear to be covered with blood-tinged exudate, and the heart muscle is greyish black due to exudation of blood, while there is usually endocarditis present. The spleen is normal in size ((different to anthrax and red water).

Treatment is not possible. Carcases and all contaminated fodder, etc., must be burnt. Stock should be removed from the paddock where mortality has occurred, preferably on to higher ground.

The spread of the disease may be prevented by inoculating all stock under two years of age with Blackleg Vaccine before placing them on infected paddocks. Vaccine may be obtained from wholesale druggists or from Commonwealth Serum Laboratories. Aggressin vaccine is safest as it does not contain any germs.

Paddocks in which deaths have occurred remain infected and are likely to be responsible for losses in the autumn if stock are not inoculated. These paddocks should be reserved for stock over two years old or put into cultivation for a few years.

Blackleg Vaccine is 100 per cent. effective in preventing infection.

BLOWFLY PARASITE.

THE RED-LEGGED CHALCID.

Stenosterys Fulvoventralis (Dodd).

Order *Hymenoptera*. Family *Encyritidae*. Genus *Stenosterys*.

By L. J. NEWMAN, F.E.S. Entomologist, and
H. G. ANDREWARTHA, B.Sc.Agr., Agricultural Adviser.

There are several species of blowflies in this State which cause considerable loss to our sheep farmers. Taking Australia as a whole, the loss of sheep runs into several millions annually. It is, unfortunately, the breeding ewes in the main that are attacked, and hence the natural increase is also retarded.

The effect upon sheep when badly struck by the blowfly almost beggars description, particularly when once the maggots get through the skin.

All growers who have seen sheep in this condition agree that there are few more pitiable sights in nature than a "maggoty" sheep.

To determine the actual species of flies responsible for this serious loss, a blowfly survey of the South-West is now being made.

A number of centres have been chosen, namely, the State Experimental farms at Chapman, Wongan Hills, Dampawah, Merredin, Avondale, Salmon Gums, and the Insectary grounds, Perth. Each farm was supplied with a West Australian blowfly trap, together with instructions how to bait and set up and how to forward the flies each month.

The findings of this survey will eventually be published in graph form, showing the relative abundance of each species of fly every month of the year.

There are many ways in which the ravages and consequent losses by these flies can be reduced. This need for action has resulted in much experimental work with the view of finding some artificial repellents, sprays and dipping mediums, that can be safely applied to the sheep. Many preparations, some effective, others useless, have been placed upon the market for spraying, jetting or dipping. Various types of traps have also been invented, some proving very useful.

A great check can be accomplished by practising farm sanitation, which means the destruction of all dead carcasses or other matter likely to be used as breeding mediums.

Unfortunately we have always to reckon with the careless and indifferent growers, who will not take the trouble to protect their sheep or to dispose of dead animals, hence in spite of all that has been done by other growers, the blowflies are still a very serious factor to the sheep farmer, and, indirectly, to the general community.

It is not intended in this article to expatiate upon artificial methods. With the desire to help overcome this great loss, the Entomological Branch has been intently studying and experimenting with some of the natural insect parasites of the blowflies. In this biological effort we have reared and distributed many hundreds of thousands of the chalcid wasp, known as

Mormoniella brevicornis. This wasp has a great weakness, in that it only attacks the pupae, which renders its powers of usefulness very limited. The bulk of the blowfly maggots bury themselves in the soil, or other suitable shelter, before pupating, and hence are immune from attack by this parasite. It of course exercises a certain amount of control and is therefore beneficial. There are a number of other minor parasites which have been noted during our work.

The introduced parasite (*Alysia manducator*) is being reared, and when in sufficient numbers will be liberated. The most encouraging of all the parasites we have handled to date is the Chalcid Wasp, *Stenosterys fulvoventralis*, commonly known as the Red-legged Chalcid. This tiny wasp was first found in our South Coast country. Since its discovery we have established it in several districts and have reared and distributed many thousands amongst the sheep flocks. It is easy to handle and readily attacks the larvae and pupae of all species of sheep blowflies other than *Ophyra nigra*.

This chalcid has been reported as occurring casually in Eastern Australia. Little effort appears to have been made to breed it up or to test its value. We venture the opinion that probably the local strain is more virile than the Eastern States form.

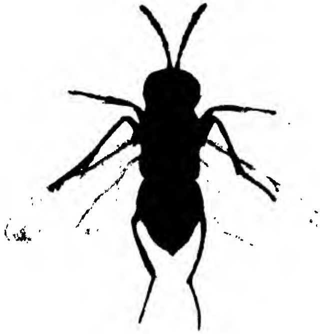
A strong colony has been supplied to the Federal Entomological Department, Canberra, for experimental purposes. Should our assumption that we have found a more virile strain of Stenosterys than has been previously handled in Australia be borne out, by experience in Canberra, this little wasp may prove to be of great value to the sheep industry of Australia.

Description.—Head, upper surface of thorax and under surface of abdomen, dull purplish black with metallic reflections brightest on the hind portion of the thorax, which exhibits a greenish sheen. Antennae dark chocolate brown, with the scape and first joint slightly lighter. The whole being thickly clothed with fine hairs. Legs under surface of abdomen reddish brown in live specimens, but when dead exhibit a faded dull yellowish brown. Legs clothed with dull yellowish hairs darkest at the tips of the tarsi or feet. Face, back of head and dorsal surface of thorax and sides of abdomen, bearing scattered, rather long, black hairs. The apex of the abdomen bears a tuft of long scattered rather coarse black hairs. Eyes large and almost black, occupying the main portion of front and sides of head. Wings transparent, fore pair longer than abdomen and covered with fine hairs. About one third from base of wing is to be seen a narrow V-shaped transverse clear space. The typical Chalcid stigma is to be observed. Hind wings finely crenulated and iridescent. (See Figures I. and II.)

This little wasp appears to lay from fifteen to twenty-five eggs in a single blowfly maggot or pupa. It prefers fully developed maggots, but if these are not available it will readily lay into partly grown maggots or even pupae. The eggs hatch into small, whitish, semi-transparent, legless maggots, which feed upon the material which would otherwise have gone towards the formation of a mature blowfly.

They commence operations on the fatty and non-vital parts of their host's body and only turn their attention to the brain and other vital organs when the other material has been all consumed. This always takes place after the blowfly maggot has pupated when it has no further

Fig. I.



× 12. (*Original.*)
Adult Female.

Fig. II.

× 12. (*Original.*)
Adult Male.

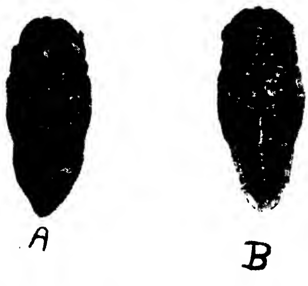
Fig. III.

× 12. (*Original.*)
Fully grown Larva.

Fig. IV.

× 4. (*Original.*)
Pupa case of the hairy maggot (*Pycnosoma rufifacies*) with some of the wall removed to show the larval parasites within.

Fig. V.



Pupae of Parasite—A: dorsal view; B: ventral view.
× 12. (*Original.*)

need to use its nerve centres. A parasitised pupa may always be distinguished from a healthy one by the presence of these tiny wasp maggots in it when it is opened. The easiest way to do this is to prick open one end with a needle or pin, when anything from fifteen to twenty-five parasites will be readily seen within it, often so tightly packed together that it is hard to imagine how they manage to exist. (See Figure IV.)

After becoming fully fed, the larvae parasites pupate within the pupa of their host. At first they are whitish and semi-transparent, but as the time for them to issue draws near they change to a purplish black. (See Figure V.) One can be sure that a pupa case which, when opened, shows these small black wasp pupae, contains parasites which will be issuing within a few days. A pupa case from which has issued parasites may be recognised by the presence of one or more small circular holes in it which the parasites have cut to make an exit for themselves.

Our observations show us that, in the field, around Perth, where this little wasp has now become well established, it may be seen in large numbers on any exposed carcase from March to November inclusive. It can still be seen during the remaining months but its numbers suffer quite a serious reduction. In the insectary it is most active in the spring and autumn months, but it also does very good work through the height of the winter. Climatic conditions, particularly temperature and atmospheric sterility play an important part in regulating the speed with which this parasite can complete its life cycle. The third column in Table I. shows the number of days which elapsed between the date on which the first eggs were laid and the date on which the first parasite appeared. The periods are compared for various reasons through the year. It was observed that in any one batch the maximum issue of the parasite usually occurred two or three days after the first, and the last always appeared within ten days of the first.

TABLE I.

Eggs laid into Maggots on	First Parasites issued	Minimum Life Cycle of Parasite in Days.
12/4/29	25/5/29	43
16/4/29	4/6/29	49
18/4/29	7/6/29	50
28/5/29	7/8/29	70
10/6/29	21/8/29	72
18/6/29	29/8/29	70
19/8/29	11/10/29	53
27/8/29	14/10/29	48
10/10/29	18/11/29	39
28/10/29	27/11/29	30
29/11/29	29/12/29	30
31/12/29	29/1/30	29

An examination of this table shows that the parasites are slowest in their development in mid-winter when the life cycle may occupy slightly over ten weeks. As the summer approaches these periods become progressively shorter until in mid-summer the whole development from egg to adult is completed in 29 days.

In order to discover the relationship between the temperature and the time taken in development we kept records of the daily maxima and minima registered in the insectary. Table II. sets out these results: Columns (1) and (2) represent the average of the temperatures recorded during the period of days shown in column (4); column (4) represents the shortest time in days taken by the parasite to complete its life cycle at the temperatures shown in the first two columns.

TABLE II.

Mean of Daily Maxima in °F.	Mean of Daily Minima in °F.	Highest Temperature recorded.	Period of Development in Days.
71·9	53·1	82·0	52
79·1	59·4	84·0	39
88·9	63·1	98·0	30
91·1	65·5	105·0	29

From the above two tables it is apparent that quite a small change in the temperature of its surroundings has quite a big effect in speeding up or slowing down its development. The two extremes are ten weeks and four weeks. In the spring and autumn months when the parasites are really most active they require about 5 to 7 weeks to reach maturity. (See Table I.) Although higher temperatures result in a more rapid growth they nevertheless do not seem to agree so well with the parasite. High temperatures seem always to be associated with a lack of vitality and activity in the parasites. In the insectary this decline in virility appeared to set in when the average of the daily maxima readings reached about 88° F. It is evidenced by a general sluggishness on the part of the adults. They refuse to be strongly attracted to light and the females do not display much ardour in searching out and laying into the maggots. Further, during the hot sterile conditions which prevail around Perth in the mid-summer months of December and January, a large number of these wasps fail to cut a way out of the pupa case after reaching maturity. This may be due to two reasons. Firstly the wasp itself is weaker and less able to cut an exit hole for itself, and secondly the pupa case is probably much tougher than it would be under moister conditions. This trouble is most pronounced when the hairy maggot (*Pycnosoma rufifacies*) is the host. The parasites seem to be quite capable of laying into this maggot at any time, and in the spring and autumn months they have no difficulty in cutting a way out, but in the mid-summer months the mortality of fully developed parasites within this hairy pupa case is often very high indeed.

It would appear that in the field these factors are never sufficient to wipe out the parasite altogether. Although the carry over thread through these months may be slender, thanks to its very great fecundity its numbers increase rapidly so soon as weather conditions are suitable. This increase usually becomes apparent late in February and early in March. These facts, together with the tendency for this wasp to be most active when the flies are causing the most serious damage to sheep are a good augury for its success and usefulness. The ultimate test of these qualities will, of course, only have been made after it has been given every chance to establish itself thoroughly throughout our wool-growing districts.

In order to do this we are continuing our work of breeding these parasites and we hope to have further supplies for distribution in the autumn and spring of this year. Growers who are desirous of establishing this beneficial insect on their farms should apply to this Department for a colony.

The wasps are distributed while they are still within the blowfly pupa case. An effort is always made to judge the despatch of these packages so that the wasps will emerge a few days to a week after they arrive. But in order to be on the safe side it is wise to open the package in the field alongside a flyblown carcase. If this is done any parasites which have already issued will be sure to find their way directly to their hosts. After opening the box and removing the cotton wool packing, place it in a clear jar containing a little moist sand and covered with some cloth such as calico or muslin. The jar should be kept in a cool place and examined daily, and as the parasites emerge liberate them on a maggot-infested carcase.

An alternative method of establishing the wasps is to remove the parasitised blowfly pupae from the box and scatter them carefully in sheltered positions under the carcase. On no account should they be placed where they will be exposed to the sun, as it would mean certain death to the tiny wasps within them. This method has the disadvantage that some of the pupae may be destroyed by carnivorous beetles and other predators before the parasites emerge. It has the advantage, however, of being easier and involves less care and attention.

Once the parasites have been established in one part of a farm or district much good work can be done in spreading them if the farmer collect parasitised pupae from under a carcase and distribute them to other parts of the farm or to other farms in his district. Unless the parasites are very numerous any attempt to breed them for distribution on the farm might quite easily result in producing far more blowflies than parasites since there will probably be a large percentage of the former which will escape and pupate in the soil without ever having been parasitised. If the carcase used for this purpose is enclosed in a gauze frame or placed in a tin with a gauze cover, this will prevent the flies from escaping, but will permit the exit of the parasite.

The breeding and spreading of these parasites will be found to be exceedingly interesting and profitable.

CONCRETE ON THE FARM.

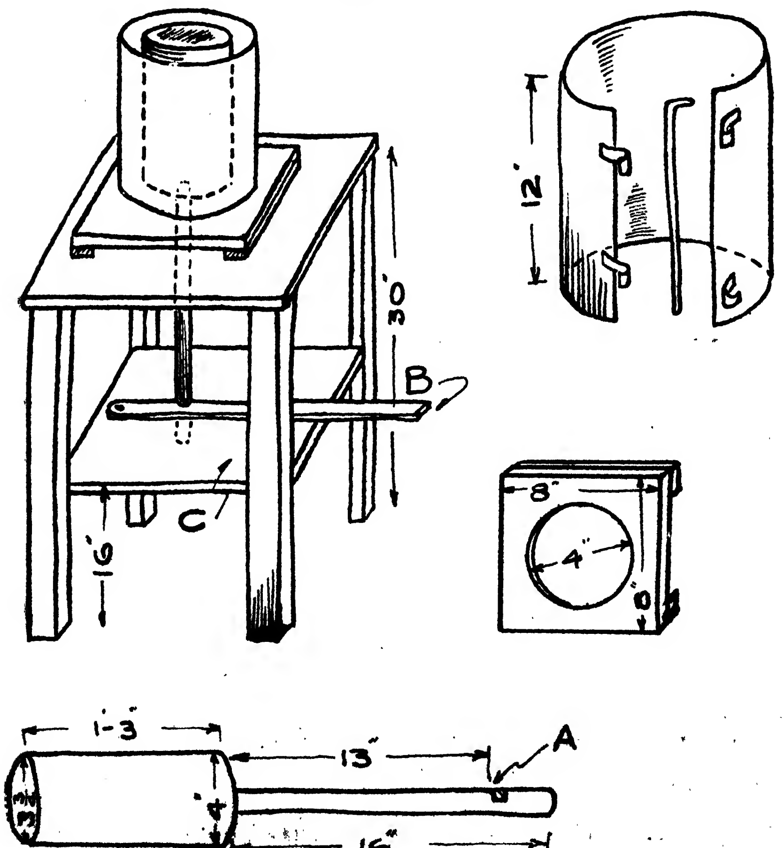
(Concluded.)

By Courtesy of the Swan Cement Company.

CONCRETE DRAIN PIPES.

A good mixture for concrete drain pipes consists of one part Portland cement, four parts coarse sand, and three parts of small gravel or stone. This will make a very porous pipe which is desirable. Using such a mixture as this one bag of cement will make approximately 50 pipes having an opening of 4 inches in diameter and an outside diameter of 6 inches by 12 inches long. A simple mould for making pipes is shown below. The table

Fig. 1.



Pallet Boards and Moulds for Concrete Drain Pipes.

should be 16in. square by 30in. high with a 4in. hole in the centre for the core of the pipe to pass through. Fourteen inches below the top is a support for the lever which holds the core when raised. The lever is inserted in the notch "A" of the core. When raised, the bottom of the core cylinder is one inch below the top of the table, and the pallet board is placed over it. These pallet boards are eight inches square with a four-inch round opening in the centre, two cleats are provided to prevent warping. As the pipe must remain on these pallets until the cement has set, it is necessary to have as many pallet boards as pipes made per day, as the pipe should remain on them undisturbed for at least 24 hours. After the pallet is placed over the core, the shell is then placed around the core and on the pallet board. This shell can be made by any tinsmith, using a sheet of galvanised iron 12in. x 20in. Four curved hooks are riveted on as shown in detail. These hooks pass each other and the latch rod is placed in them. The concrete is tamped inside the shell round the core and so forms the pipe. To remove the pipe, first draw the lever "B" which releases the core; then tap the core on top and it will drop 13in. until its cylinder rests on lever "B." Next draw the latch rod out vertically, and the shell can be removed. The pallet and pipe can now be taken away and the operation repeated.

A suitable tamper can be made from a block of iron 2in. square and $\frac{5}{8}$in. thick. On one edge insert a half-inch diameter bar two feet long for a handle. The core, which is made of wood, is $\frac{1}{4}$in. less in diameter at the top than the bottom. This facilitates its easy removal from the pipe and prevents cracking same. The rod inserted into this core, may be of wood or iron; an old fork handle is quite suitable. The hole for the rod to pass through board "C" should be such that it cannot sway the core when it is lowered, as this is liable to break the pipe. The concrete used must be mixed with just sufficient water to enable packing, and after the pipes are several hours old they should be sprinkled with clean water every six to eight hours for several days. Pipes can be laid in the ground when but a few days old as the dampness in the soil should be sufficient to continue the hardening of the concrete. The parts of this mould should be coated with shellac before using, and the pallet boards should be kept from sunlight or well painted before using. The metal parts of the mould will readily free themselves from concrete if frequently oiled with harvester or common machine oil.

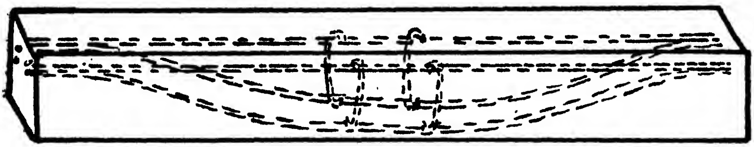
BEAMS.

The following is a simple method of calculation of small reinforced concrete beams and is culled from the pages of "Concrete for House, Farm, and Estate," a handy little publication by Fred Ballard:—

"In most building construction the question of beams is an important factor. A broad and safe formula for a reinforced beam is to calculate 1in. of depth for every foot run: thus, a beam of 12 feet span would be one foot deep, and the width should be at least half the depth. A greater width in beams is often better; a 9in. width works conveniently with brickwork. A 12 foot beam reinforced with four bars ½in. square, two bars placed within ¾in. of the bottom of the beam and 1in. from the outer edge, and two bars on top of the beam, with four pot hooks placed within one foot of the centre and connecting the bottom bars with the top ones, will suffice for any ordin-

ary building construction. Additional strength can undoubtedly be given by bending the bottom bars at a distance of one-third from the end of the beam and taking them up to the top edge, as shown in Fig. II.; the tensile and compressive forces are better met with in this manner. The beam must be securely propped during construction; no false work, but particularly strong and sound timbering is necessary. Any jarring or vibration should be avoided until the concrete is well set, and in no case should the props be removed in less than four weeks; and if longer time can be given, it is better."

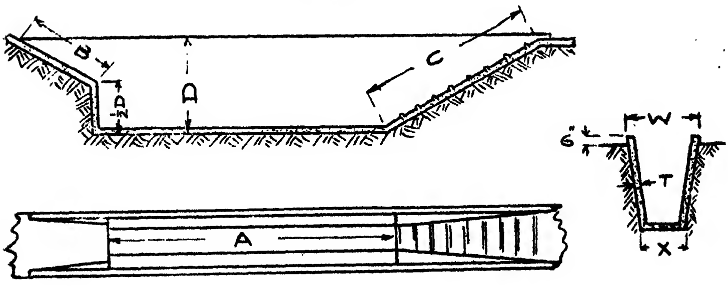
Fig. II.



CONCRETE DIPPING TANKS.

The construction of a concrete dipping tank presents little difficulty to the man on the farm, once the sizes and quantities of material have been decided. The following table will be found helpful in this respect and the quantities given are based on the use of a 4-2-1 mix. Great care should be taken with the tamping in of the concrete if a good watertight job is to result.

Fig. III.



KIND	A	B	C	D	W	X	T	BAGS CEMENT	SAND	STONE
Horses	31'-0"	8'-8"	18'-7"	8'-8"	5'-10"	3'-4"	8"	114	11 Yds	22 Yds
Cattle	31'-0"	7'-8"	15'-4"	7'-8"	5'-4"	3'-4"	8"	108	10½ "	21 "
Sheep	31'-0"	5'-8"	11'-6"	5'-8"	3'-4"	2'-4"	8"	66	6½ "	13 "
Hogs	21'-0"	5'-8"	11'-6"	5'-8"	3'-4"	2'-4"	8"	57	5½ "	11 "

Dimensions and Quantities for Dipping Tanks.

UNDERGROUND TANKS.

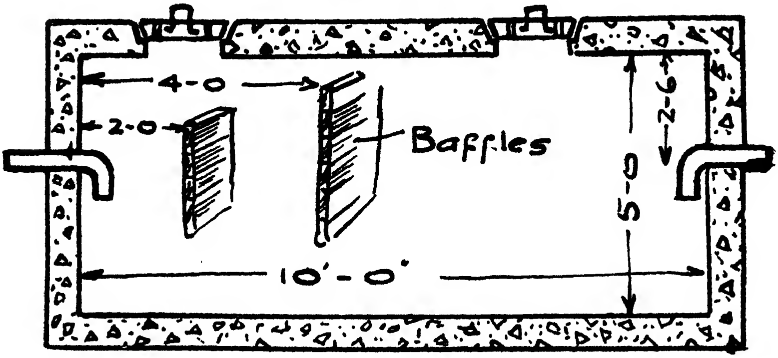
In the construction of underground concrete tanks the earthwork should be first of all got out with as little disturbance to the ground against which the walls are to rest as possible. A convenient depth is about eight feet. If the ground is solid and will stand up it will only be necessary to have wooden framing on the inside. This should be set to the required sizes and strutted across by timbers to prevent bulging when the concrete is being tamped in. The floor should be 5in. thick reinforced with ⅜in round bars at 18in. centres both ways (at right angles). The bars should be tied together at the crossings with wire, making a sort of large mesh netting. This reinforcement should be placed ½in. from the top of the floor and also a similar reinforcement about 1in. from the bottom. While the concrete is being put into place this iron can be held in position by lumps of stone placed in between the mesh as the work proceeds. The walls should be 6in. thick, and reinforced every 9in. in the centre of the wall with a vertical bar ⅜in. diameter, and at every 18in. rise on these vertical bars a horizontal bar or strong wire should be placed. The top of the wall should be about a foot above ground level, and if a roof is to be put on it will be as well to set a few bolts in the top of the wall at intervals, so that the timber work of the roof can be bolted down tightly. A point to remember is that if the bottom of the tank is put in one day and the walls a day or so afterwards it is necessary to stud the bottom round with pieces of iron of the same size as used in reinforcing the walls, putting them well into the concrete in the wall line, and allowing them to stand up six to nine inches above the bottom; the vertical bars then come down against them, forming a tie equivalent to a continuous bar of iron. Short studs are better than long bars, the latter being easily knocked out of position and the cement joint between iron and concrete broken. In constructing tanks it is advisable to use a fairly small size stone, say about ¾in. to 1in. diameter, and to tamp all concrete well so that a good solid concrete is obtained. The above details are for comparatively small tanks, very large tanks will entail greater strength and may need the guidance of a special enginer.

SEPTIC TANKS.

Septic tanks are nothing but long underground water-tight cisterns through which the sewage passes very slowly and evenly—located underground, they are warm and dark—ideal conditions for the development of the bacteria, little germs which eat up the sewage and render it harmless in much the same way as another kind causes cider to ferment. To prevent the bacteria (which live in the frothy sludge) from being disturbed cross walls, called baffle boards, are placed to break up the current from the incoming sewage. The purified sewage, merely clean water, may be discharged into the farm drain pipe. Locate the septic tank where it can be placed entirely with the side walls underground and out of danger of flood waters. For a family of eight or ten, construct a tank with eight inch walls, five feet deep by five feet wide by 10 feet long—all dimensions inside. Before filling the forms with concrete (4:2:1 mix) set in the six-inch inlet and outlet drains at the same height, two feet six inches below ground level. To aid further in breaking up the currents and keeping out too much air, use elbow bends, so that the sewage in the tank will cover the mouth of the drain. In the side

forms, at a distance of two and four feet from the inlet wall, set ⅜in. bolts to which the baffle boards will later be attached. These boards reach entirely across the tank, project above the sewage, and extend to within one foot of the bottom. While building the manhole covers for the needed ventilation insert in them four short lengths of 1in. gas pipe, also a piece of bent iron to form a lifting handle. A tank built to the above dimensions would take approximately 27 bags of cement to construct—using a 4:2:1 mixture.

Fig. IV.



SEPTIC TANK.

CEMENTING GALVANISED IRON TANK.

It is usual to do this work from the inside only, as it makes a much stronger job, and the tank retains its original appearance outside. All dust and dirt must be scrubbed off the sides, and the bottom cleaned out. A solid stand is essential, of brick, concrete or masonry, because once cemented a tank becomes too heavy to move, and timber, even jarrah, will eventually rot.

The bottom of the tank must be well bedded and filled with three inches of 4:2:1 cement concrete, well spaded into the tank corners. Before this is put in, the outlet must be extended upwards so that the draw off is still about three inches above the new level. Also, the first rings of wire netting must be placed so that it will lock into the bottom concrete. Reinforcement in the bottom is not necessary, but makes a safer job. Expanded metal or a good stout wire netting are both suitable.

The wire netting may be expanded inside the tank and pressed up against the sides so tightly that it will remain there of its own accord, there being no need to punch holes to hold it. The rendering up is then done with a 1 : 3 cement mortar, with, for preference, about 5 per cent. of hydrated lime to assist in the waterproofing. The coat should be thrown on rather than trowelled, and the rough surface so obtained will give an excellent coat for the final rendering, which should not be much more than a quarter inch thick.

For this work a well-graded sand, free from very coarse particles, must be used. The last coat must be trowelled hard, but must not be excessively wet, otherwise surface cracks will be formed by the flushing out of the cement and subsequent shrinkage.

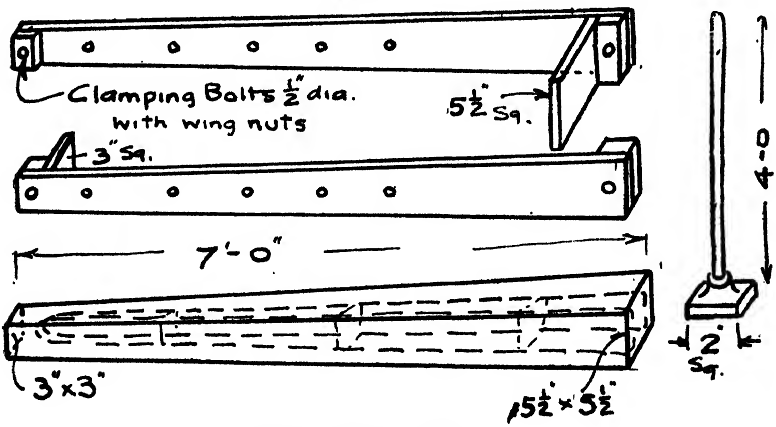
A good round between the sides and the bottom is essential. The last job of all is rendering the bottom, a full half inch in thickness, taking especial care with the joint between the sides and the bottom.

The worst job of all will be getting out of the tank at the finish without damaging the sides or the bottom, and the only way of doing this satisfactorily is to sling a beam across the manhole above the tank and crawl up a rope ladder. The final touches to the bottom may be given first standing on a board and then swinging from the ladder itself.

CONCRETE FENCE POSTS.

Fence posts should be constructed with a mixture of one part cement, two parts sand, and three parts of small stone, say about ½in. to ¾in. diameter. A simple form for making posts is shown below, the dimensions, however, can be altered to suit individual requirements. The post shown contains one cubic foot of solid concrete, and using the above mixture about

Fig. V.



Concrete Fence Posts.

4½ posts can be made from a bag of cement. Reinforcement should consist of two wires or rods ¼in. diameter bent hairpin shape, the end should be bent over and the rods wired together at two or three points along. The posts should be made on a solid floor, a concrete floor is the best. This floor should be sprinkled with dry sand and the mould placed and filled. The mould is then removed, as the post must remain undisturbed for at least two days. The concrete is stamped into the form with a tamper similar to that depicted below. If small holes are required to take wire through the post, steel or iron rods are passed through the wood sides in the holes provided so that they will be embedded in the post. These rods are pulled out when

stripping the mould off. If wire netting is to be hung on the posts, galvanised iron wire is embedded in the concrete so that about one inch projects from the side of the post. This projecting end is twisted round the netting when it is placed in position.

A FOOTPATH FOR LIGHT TRAFFIC.

First of all set out the position of the footpath, by means of wooden battens as shown above, and level off the ground on which the path is to be laid. Next procure some old bricks and break them up iuto pieces about two inches in diameter and pack them tightly in between the wooden battens, so forming a solid foundation for the path. Tamp the bricks down as evenly as possible and then saturate with water. The foundation is then ready to receive the cement mortar which should consist of two parts of clean sand (free from roots, etc.) to one part of cement. The cement and sand should be well mixed in a dry state and then the clean water added and again mixed until the mixture becomes plastic enough to work. Place the mortar right on to the wetted bricks and trowel off level with the top of the battens. Allow to set for a few hours and then cover with wet bags and keep damp for a day or two. On no account allow the water to dry out of the path too quickly, otherwise it will show a tendency to crumble and powder when put into use. If it is desired to colour the path, say red, it will be necessary to obtain some red oxide—this is worked into the surface of the path with a steel float—the quantity required depends to a great extent upon the density of the colour required, and the quality of the oxide, and is best found by experiment. Generally about 1 lb. will cover about 90 square feet.

One bag of cement (125 lbs.) will make enough mortar to cover approximately 15 square feet, consequently a path three feet wide would take one bag of cement for every five feet run.

GENERAL.

There seems to be an idea prevalent in many people's minds that there is some latent difficulty in making concrete. It is certain that some concrete is better than others; but the general concensus of opinion among those who have had most experience of working with concrete, and other means of building—wood, brick, galvanised iron, wattle and dab and pisé—is that concrete, either built solid or in situ, or with hollow blocks, presents no difficulties, and is as simple as it looks. With only ordinary care in keeping the cement dry up to the time it is used, obtaining clean, sharp sand and good gravel or broken stone, a creditable permanent structure can be built without any previous experience of masonry or bricklaying. This fact alone should commend it to the careful attention of those about to build.

COLOURING CEMENT.

The following proportions will form a useful guide for those who are desirous of having a coloured finish to their concrete:—

Red.

86 parts Portland cement.
14 parts red oxide of iron.

Yellow.

88 parts Portland cement.
12 parts yellow ochre.

Blue.

86 parts Portland cement.
14 parts azure blue or ultramarine.

Green.

90 parts Portland cement.
10 parts oxide of chromium.

Chocolate.

88 parts Portland cement.
6 parts black oxide of manganese.
4 parts black oxide of iron.
2 parts black oxide of iron or copper.

Black.

90 parts Portland cement.
10 parts black oxide of manganese or any carbon black.

Pink.

97 parts Portland cement.
3 parts best quality crimson lake.

USEFUL INFORMATION.

1 ton of cement is contained in 18 bags of Swan cement.
Each bag contains approximately 125 lbs., equal to 1 1/3rd cubic feet.
Three bags are equal to 1 cask of cement.
1 ton of sand equals 22 cubic feet.
1 gallon of water weighs 10 lbs.
1 cubic foot of water weighs 62½ lbs.
1 bag of cement mixed as neat cement mortar will cover 14 square feet 1 inch thick.
1 bag of cement mixed with 1 of sand will cover 22 square feet 1 inch thick.
1 bag of cement mixed with 2 of sand will cover 33 square feet 1 inch thick.
1 bag of cement mixed with 3 of sand will cover 45 square feet 1 inch thick.

Floors.

1 bag of cement mixed 4:2:1 will cover the following areas:—

4in. thick	2.1 sq. yds.
5in. thick	1.7 sq. yds.
6in. thick	1.4 sq. yds.
7in. thick	1.2 sq. yds.

Mass Concrete.

1 bag of cement will make the following quantity of concrete:—

Mixed 4 stone 2 sand 1 cement	5.4 cubic feet.
Mixed 5 stone 2½ sand 1 cement ..	6.7 cubic feet.
Mixed 6 stone 3 sand 1 cement	7.7 cubic feet.

To make 1 cubic yard of concrete 4:2:1 mix requires 4½ bags of cement.

THE BLUE PIMPERNEL.

(*Anagallis femina*, Mill.)

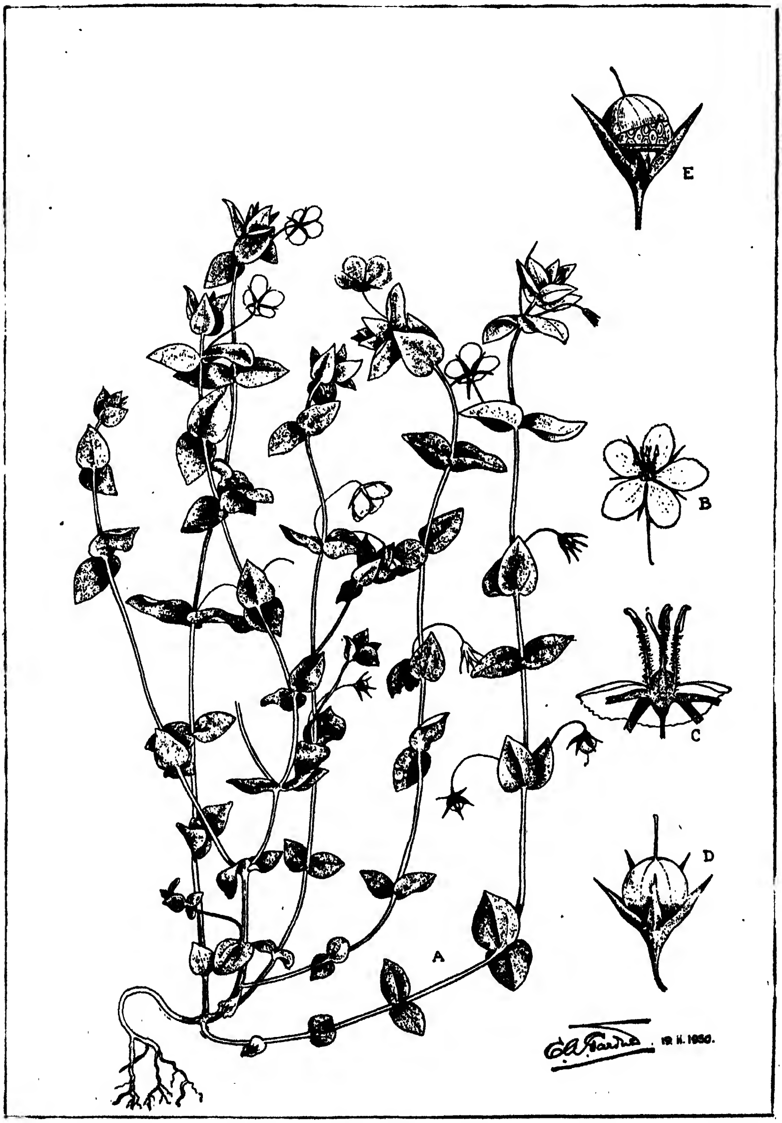
C. A. GARDNER,
Government Botanist.

There are two Pimpernels in Western Australia both of which have been introduced from Europe—the Scarlet and the Blue. The Blue Pimpernel, however, is much the more prevalent species of the two, and may be found occurring almost everywhere where settlement has penetrated in this State. It is a small trailing or ascending weed favouring damp situations such as depressions or creeks moist in winter, and in such places it may be found flowering between the months of June and October, although in inland localities it may appear and flower after summer rains, or in shady spots its flowering season may continue until November. As a rule it dies down with the approach of summer dryness. This pretty annual has been accused of being poisonous, and there appears to be little doubt that such is the case. All reports, however, deal with *Anagallis arvensis*, the "Scarlet Pimpernel," but until recent years the blue and red pimpernels were treated as varieties or forms of the one plant, and many botanists still hold this view. The differences between the two are very slight, and it appears reasonable to suppose that if the red pimpernel is toxic, the blue is also toxic.

H. C. Long, "Plants Poisonous to Live Stock" (1924), states that if eaten in sufficient quantity, Pimpernel has a poisonous action, having an irritant action on the digestive tract—the intestines—as well as producing narcotic effects. Bailey says "a dog is stated to have been destroyed by making it swallow three drachms of the extract of the plant," while another author states that the fluid extract in four drachm doses is fatal to dogs (the size of the dogs not being mentioned). In Lyons at the Veterinary School, horses were intentionally killed by administering a decoction of the plant. Ewart (Victoria) says that "it has been reported to render the chaff from oat crops infested by the weed unpalatable to stock." and Professor Gilruth states that about 1911 it was responsible for the death of a large number of sheep in Victoria, apparently acting as a narcotic poison. On the Pacific coast the plant is known as "Poison Weed," and Grognier and Orfila are stated to have put its poisonous properties beyond doubt.

It would appear from the above that the Scarlet Pimpernel is therefore undoubtedly poisonous, and this being the case, there is reason to suspect the Blue Pimpernel also. At the same time we know of no authentic cases of poisoning from either plant in Western Australia. The plant is not readily eaten by stock, especially when other feed is available, and for this reason no cases of poisoning in this country have come under our notice. It grows at the time of the year when feed is usually prevalent, but if the plants should be found growing in abundance in isolated damp spots during summer when feed is scarce, there may be some real danger from stock eating this plant, in searching for green mouthsful. The exact position concerning Blue Pimpernel is most unsatisfactory because of the confusion which has existed between the two plants, but the weed is so common in our agricultural districts in the spring, with only few cases arousing suspicion, that the effects from eating it, if any, do not warrant any action being taken beyond

the ordinary methods adopted for weed control. On the other hand where the weed is found in summer, there may be a source of danger, especially with the Scarlet Pimpernel, and eradication may be advisable.



Explanation of Plate.

A, plant, showing habit of growth (half natural size). B, flower (about natural size). C, details of ovary style and stamens (enlarged). D, fruit (slightly enlarged). E, fruit opening, showing the falling cap and

Both plants are annual, and may be controlled by preventing the possibility of seeding. Frequent cultivation and harrowing, and clean fallows will do much to cope with the weed where it occurs abundantly.

Description of the Plant.—A procumbent or ascending much-branched glabrous annual, 6 to above 12 inches high. Leaves opposite, sessile, broadly ovate, obtuse, usually ¼ to ½ inch long. Flowers blue on slender axillary pedicels, longer than the leaves, recurving as the fruit ripens. Calyx 5-cleft, corolla rotate, deeply 5-lobed. Stamens 5, the filaments woolly-hairy, anthers with parallel cells. Fruit a pyxidium—*i.e.*, a capsule opening transversely—with a globular placenta and numerous seeds.

Original home Europe. Common in shady spots on the western coastal plain, extending eastwards to the Goldfields, usually in depressions.

HORTICULTURAL NOTES.

GEO. W. WICKENS,
Superintendent of Horticulture.

STONE FRUITS.

When this issue reaches the growers summer will have waned, and autumn tints be showing on trees and vines of varieties maturing their fruit in the earlier part of the season. The talk of the glut of stone fruit will have subsided and thoughts of it live mainly in the minds of those whose income was much below expectations owing to a large portion of the crop being either unsaleable or saleable only at prices that barely covered the cost of cases and the seller's commission. If it were Nature's plan to produce excessive crops in successive seasons, her lessons would be more readily learned, and not easily forgotten, but with very light crops usually following very heavy crops, the experience of the too-bountiful season is forgotten in the lean season, and so the mistake of allowing the trees to again over-produce is perpetuated.

Unless something in the nature of a miracle occurs, the stone fruit crop in season 1930-31 will be a very meagre one indeed. Not only did the trees suffer from over-cropping in the present season, but continued dry weather in summer, following a winter with a rainfall below the average, has also had its effect in limiting growth and preventing fruit buds from developing. In addition, the limbs of many old trees have broken down badly under the weight of fruit, and these combined circumstances make it certain that the major portion of next season's stone fruit crop must be looked for on younger trees, just reaching bearing age. So it will happen that many growers will add to the losses sustained in the year when prices were low, the lack of receipts in the following year when prices are high, but fruit absent. To fail to derive income from an orchard both in the heavy and light years is a disastrous state of affairs, and can be guarded against by

preventing the trees from over-cropping. This is done by keeping the trees in good heart with manure and cultivation, reducing the fruiting wood by judicious pruning, and heavily thinning the young fruits; not only will this treatment prevent over-cropping in the abundant season, but will also materially assist in the production of fruit in the light season.

Before leaving this subject I would like to state there was no glut of really prime fruit this season; prime fruit did not bring at times the price it should, but there was always a sale for it, and the low price was due to the bearing down effect caused by the quantities of rubbish on offer at the same time. "Keep the rubbish off the market" is a good slogan, but "Avoid producing rubbish" is a better one. No grower can be certain that he can make his trees (particularly stone fruit trees) produce a crop in a given season, for after the utmost care bad weather conditions or disease might nullify his efforts, but every intelligent orchardist can and should prevent his trees from over-cropping.

APPLES.

Great is the change this season from the fruit shipping activities of last. During the twelve months ending 30th June, 1929, 737,676 cases of fruit were shipped from Western Australia to overseas markets, and in the same period 166,032 cases were shipped to the Eastern States, making a total export for the year of 903,708 cases. This year shipping space booked for overseas markets is under 170,000 cases, and it is most unlikely that any fruit will be sent to the Eastern States.

The great falling off in export is due to the light crop of apples, which will probably amount to little more than one third of last season's production, and what this means in the export trade is shown by the fact that of the 903,708 cases mentioned above as having been sent out of Western Australia, 821,014, or over 90 per cent. of the total, consisted of apples.

Just as the stone fruit growers in season 1929-30 had an over-crop with a large proportion of it undersized, so may the apple growers in season 1930-31 have a similar experience unless they take the necessary steps to prevent it, by pruning severely, manuring heavily, cultivating thoroughly, and thinning drastically.

ORANGES.

The orange crop this year, that is the crop which will commence ripening from the latter part of May onwards, promises to be well in advance of last year's yield. The average production for the last five years for which figures are available amounts to 206,674 cases per annum, and at time of writing—February—it looks as though this year's crop will exceed that by about 20 per cent., but the very dry weather now being experienced, and last winter's rainfall being under the average, renders a crop estimate at the present time a dubious matter, for in some orangeries which have not facilities for irrigation, a number of trees are drought stricken, and unless rain falls in the near future will fail to mature their fruit. I have visited many citrus orchards within the last few weeks for the purpose of forming an estimate of the coming crop, and have noticed in several places where irrigation was being practised that the first watering had been too long delayed, the trees having been allowed to partially wilt before moisture was supplied to the soil, and the effect of this has been, what is common under such circumstances, an out-of-season blooming which, whether it produces fruit or not, is bad for the trees and unprofitable to the grower.

In a few weeks' time from date of writing it will be possible to judge fairly accurately if my estimate of a 20 per cent. increase, which means a crop of about 250,000 cases, will be approximately correct or otherwise, and if my expectations are realised it will be the heaviest yield, bar one, since the industry started in Western Australia. The exception referred to was in season 1923-24, when the record for the State was established with 264,160 cases; 1924 was also the peak year for area, which then amounted to 3,251 acres, a total that has since steadily declined until it now stands at 2,931 acres. I am satisfied this decline has not been brought about through a difficulty in obtaining a payable price for the product, because during the last five years good oranges have sold well in Western Australia despite the fact that the quantity exported decreased during that period. No! a tour through the orange growing districts will soon convince any one that the lessening area is due to trees having been planted in unsuitable situations, and later taken out to make room for something more profitable under the existing conditions. Sometimes the soil has been the trouble, at others there has been too much water, and again too little, but whatever the cause the rooting out is a warning to property holders in those localities not to tread in the same path, and so new plantations do not take the place of the demolished ones.

As a matter of fact while there are thousands of acres in Western Australia which are eminently suitable for growing apple, pear, stone fruit trees and grape vines, it is not easy to find a large area of land suitable for orange growing. The difficulty arises because the land must not be situated in the colder parts of the South and South-West, where the rainfall is ample, because climatic conditions are there unsuitable, and further North, where climate and soil are right, lack of water is mostly the limiting factor.

For this reason, with a steadily increasing population there seems to be little fear of over-production, and where soil is suitable, the climate right, and sufficient rainfall or water for irrigation available, orange planting is still a sound proposition.

I noticed last winter that a number of orange growers had failed to apply Bordeaux Mixture—4:4:50—or Burgundy—4:6:50—in time to prevent Citrus Brown Rot from appearing and damaging the trees, and I take this opportunity of advising that the spraying should be carried out before the end of April.

THE EFFECT OF SUPERPHOSPHATE ON SUBTERRANEAN CLOVER SEED.

A. B. ADAMS, B.Sc. Agr.

It is generally known that superphosphate has an injurious effect on some seeds, particularly when the seeds are in contact with it for a lengthy period.* There is, however, but little definite information available showing the effect of superphosphate on Subterranean Clover seed.

The popular ideas on the subject are hazy, some think much injury is caused, while others are of opinion that the acid of the superphosphate has some beneficial effect by softening the hard-shelled seeds.

* Jour. of Agric., W.A., Sept., 1928, "The Sowing of Small Seeds," G. K. Baron-Hay.

The experiments described below were carried out with the object of throwing some light on the subject.

The seed used was clean seed, of the first early variety of Subterranean Clover. Both old and new season's superphosphate was used, but keeping the superphosphate for a period had no appreciable effect on the result.

The method of testing followed was to mix a quantity of seed with superphosphate, and at various subsequent periods to remove a number of seeds and compare their germination with the germination of an equal number of seeds that had not been in contact with the fertiliser.

In the first experiment the seeds were mixed with superphosphate for nine days, and were then tested for germination with the following result:—

Untreated—41 per cent. germinated.
Treated—31 per cent. germinated.

The experiment was repeated a number of times, leaving the seed in the superphosphate for longer and shorter periods. Lengthening the period did not materially decrease the percentage, but shortening the time to 24 hours raised the percentage of germinating seeds to the level of those untreated. Although the percentage was the same there was a slight delay in the time, showing that the fertiliser was commencing to take effect on the seed. As a short exposure causes a drop in the percentage of germination, and a very long exposure has little further effect, it would make one surmise that the seeds vary in degree of susceptibility. This was found to be the case.

On washing the seeds and examining them carefully, a difference in the colour of the seed coat was noted; the majority of the seeds were a purplish black, but about ten per cent. were of a dark red appearance.

On separating the colours and testing them separately, it was found that the red seeds germinated more quickly when untreated, but were easily injured by the fertiliser, and if left in contact with it for more than 24 hours their germination was seriously delayed, even if the embryo was not killed. The seat of the injury is the radicle, as some of the red seeds left in superphosphate for 48 hours germinated after 14 days (the normal time is two to four days), but the germination was not normal as the seed leaves developed without the corresponding growth of the root system. In normal growth the radicle is the first part to appear.

The purple-black seeds did not suffer even when left in the superphosphate for many weeks.

The seeds which did not germinate at all were mostly purple-black seeds of a smaller size, and were presumably hard shelled, as they were quite unaffected when left in damp blotting paper for long periods.

Summary.—The effect of mixing Subterranean Clover seed with superphosphate before sowing will vary with the sample. Some seeds are easily damaged, while others are very resistant. In practice, therefore, one will avoid risk of damage by mixing the seed and fertiliser immediately before sowing. Should, however, too much have been mixed, or if sowing is delayed from any cause, it does not follow that all the seed will have been injured, but there will probably be some decrease in the percentage of germination.

NOTES ON CULTIVATION OF THE TANGIER PEA.

G. K. BARON HAY,
Superintendent of Dairying.

During the last three seasons a considerable number of farmers have grown the Tangier Pea under field conditions, with varying success. The special qualities of the Tangier Pea, namely, heavy growth and drought resistance, have made it a plant worthy of renewed trials.

A careful perusal of the results obtained from a large number of trials show that, where cultural conditions have been reasonable, in almost every instance the plants in a failure exhibit similar characteristics. These features are very stunted growth, failure to stool, and a pink to red colour of the leaves and stems. The writer has seen plants only 9 inches high and six months old, while other plants in the same field and planted the same day are seven or eight feet high.

Mr. A. T. O'Connell, who has grown a successful crop of the Tangier Pea under field conditions for three years in succession, noticed certain areas this season in his 20 acre paddock of crop which showed the above symptoms, and was able to remedy the trouble.

Portion of 20 acres of Tangier Peas grown by Mr. A. T. O'Connell, "Waitemata," Dwarda, 23rd November, 1929.
(*Photo. by "Elder's Weekly."*)

The Tangier Pea, in common with other legumes, cannot thrive without the assistance of nitrogenous fertilisers, unless certain soil bacteria are found in association with it, and growing in colonies or nodules on its root. Those growing on the Tangier Pea are very large and numerous.

The condition described above is that expected where the crop is suffering from the lack of these bacteria. This is verified by the fact that, where farmyard manure or nitrogenous fertilisers were applied in the trials, good growths were obtained.

The bacteria affecting the roots of various species of legumes may be divided into groups, and bacteria from one group are not interchangeable with those in another. Eleven groups have thus been isolated, the bacteria

affecting the roots of the Tangier Pea being also common to the Garden Pea and Field Pea (Pisum sativum), Hairy Vetch (Vicia villosa), Broad Bean (Vicia faba), Lentil (Ervum lens), and the Sweet Pea (Lathyrus odoratus). These plants are not yet commonly grown on farms, especially in the South-West Dairy Belt, and quite probably absence of these bacteria has been a limiting factor for growth.

Tangier Peas.
Demonstration showing effects of want of inoculation. Ladies standing on the uninoculated patch. Hat can be seen on gentleman standing in peas to the left of photo. (Photo. taken 29/11/29.)

Mr. A. T. O'Connell, at Dwarda, acting on the above assumption, by inoculating the sickly portions of his crop, was able to cure the trouble, and treated plants overtook healthy ones in their growth.

Inoculation may be carried out by two methods:—

(a) By treatment of the seed prior to planting.
(b) By adding the necessary bacteria to the soil.

(a) For this method it is necessary to have an infusion either made from the nodules of healthy plants by crushing the nodules in water, or by having a culture of the bacteria available to be mixed with water or skim milk, and sprinkled on to the seed. By this method care must be taken not to expose the seed to direct sunlight before planting, and not to mix the seed with a fertiliser at sowing time.

(b) Probably the simplest method is to select soil from an area which has successfully grown any one of the following crops, and spread it on the area to be planted, at the rate of 1 cwt. per acre:—

1. Garden Pea.
2. Field Pea.
3. Vetches of any kind.
4. Broad Bean.
5. Lentil.
6. Sweet Pea.

BEE-KEEPING NOTES.

By H. WILLOUGHBY LANCE,
Science Apiculturist.

THE IMPORTANCE OF GOOD STOCK.

In all primary industries the importance of not only having the best breeds of either seed or livestock, but also of having the breed most suitable to the conditions of the district, has never been so fully realised as at the present time.

In view of this generally acknowledged fact of the importance of good blood, it is surprising to find a large number of bee-keepers who appear to be indifferent to it. In going about the country, one finds very few men who have a really first class bee; they may have a few good colonies, but they do not breed from these, nor do they purchase new pure bred queens. They let nature have its way, allowing the bees to swarm and to re-queen themselves. This method in bee-keeping, as with poultry or any other live stock, tends to the deterioration of the stock.

Selection and breeding from selection is the only way to get the best results, reduce production costs, and enable the farmer, be he bee-farmer or other, to meet competition and earn a comfortable living.

Of course this is not the only factor upon which success depends. The general method of conducting the work of the farm is most important, and then there are so many factors over which the farmer has no control, such as the weather, forest fires, etc. This, however, is a certain fact, that in a good season, with a good honey flow, any colony of bees that is fairly strong, will probably do well, even if badly neglected by the owner. But when circumstances are against the industrious bee everything depends upon the strains from which the bees have been bred. Bees from a good stock will survive and perhaps store a surplus, while the indifferent ones will go under. Practically all successful bee-keepers are careful to re-queen every colony at least every two years, and some every year, or even less if the queen does not deliver the goods.

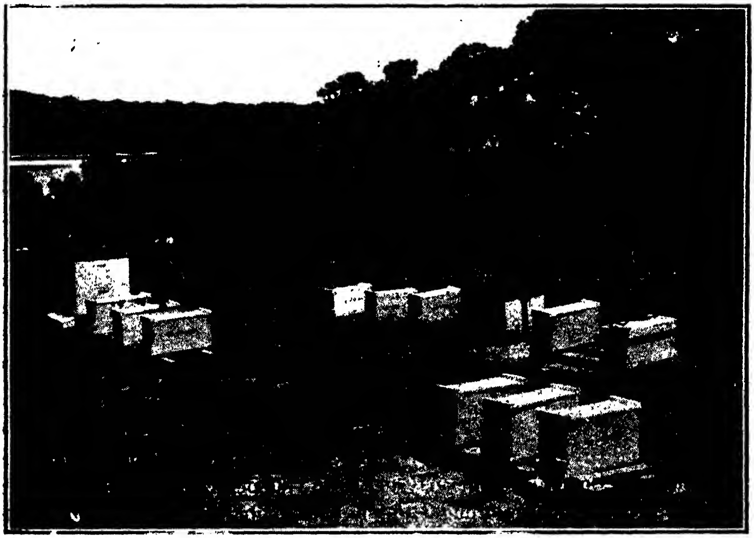
Some of them breed their own queens from their best colonies, others consider that it pays them better to concentrate on honey production and leave the queen breeding to the expert.

The Department, recognising the importance of good stock, has imported Italian queens from Italy, and Carniolans from Jugo-Slavia. Queen rearing has been carried on on a small scale this season and a few good Italian queens are available at standard prices, and anyone requiring these should apply to the Government Apiculturist without delay. Carniolans are

not available at present, as these are required for re-queening our own colonies, it being intended to concentrate on the production of this race of bees next season.

Italian queens can always be obtained from reliable breeders, but pure bred Carniolans are very difficult to obtain. It is, therefore, felt to be best in the interests of bee-keepers to leave the breeding of Italians to those who have been successful up to the present, and concentrate on the new race which is rapidly growing in favour.

It is claimed for the Carniolan that they are a longer lived bee than the Italian, that they are hardier and will work in weather that keeps the Italian at home. That they build beautiful white comb and are quiet to handle.



A portion of Rottnest Queen-mating Apiary.

A longer lived bee means a smaller proportion of brood to that of adult bees than would be the case with a short-lived bee. That, again, means less food to be consumed by the nurse bees to make the chyle food for the larvæ. It is usually considered that the life of the average worker bee during the season is about six weeks; assuming that we can obtain workers that will live eight weeks instead of six, we should save 25 per cent. of the food required for raising brood. For instance, assume that we have a hive of 30,000 bees, with our average bee this would require the hatching of 5,000 bees per week to keep up the population of the hive, or 120,000 bees in six months. With a bee living eight weeks, only 3,750 bees would require to be

hatched per week or 90,000 bees in six months, instead of 120,000. We thus realise what an immense saving there would be in food.

As regards hardiness: a beekeeper in the South-West district, that has tried some Carniolans, tells me that they worked on the Karri during the winter, while the Italians did practically nothing.

For quietness and ease of handling, our own short experience shows them to be much in advance of Italians.

The importation of queens from Europe is a difficult matter. Of four Carniolans arriving by post, none arrived alive. Mr. Pender on his return from Europe brought with him in his cabin two Carniolans, as well as a number of Italians. Of these Carniolans, only one arrived alive, and we were fortunate in securing this one. We have also received two pure Carniolans from J. D. Morgan & Son, Rushworth.

Rottnest Island has been declared a sanctuary for Carniolan bees, and the Department has established a small apiary there for mating purposes. The young queens are reared on the mainland and taken over to Rottnest in Neucleus hives for mating. Only a few have been reared so far; these will be carefully watched during the coming months, and the best used for breeding purposes next spring.

There are no Eucalyptus on the Island, but there are plenty of spring flowers—wattle, templetonia, etc., which give the bees an early start; later in the season there is the tea-tree. There are periods when there is a dearth of nectar, but the bees appear to be able to gather enough to keep them through the season. One of the difficulties of the Island is the transport question, especially during the winter and spring, but it is hoped that this will improve in the future.

Queen rearing is not as easy as some may think. There are so many factors to contend with, any of which may cause the loss of queen cells or young queens. Sometimes one may get 80 or 90 per cent. of the cells put down accepted, the queens brought to maturity, mated and laying. At other times, owing to weather conditions, cessation of honey flow, overlooking a queen cell, leaving cells too long in the completing hive, or other factors, one may only be successful in getting 25 or 30 per cent.

There are several useful books on queen rearing and anyone wishing to try his hand is recommended to obtain "Australasian Queen Rearing," by W. S. Pender.

THE RED-LEGGED EARTH MITE.

(Penthaleus destructor.)

L. J. NEWMAN, F.E.S.,
Entomologist.

The dry summer period is now nearing the end and we shall soon be entering the wet season. The advent of the rains unfortunately brings about a recrudescence of this serious pasture pest. From the time the rains ceased in November last to date of writing, we have seen little of this mite, nor have complaints been received as to its ravages. Upon the advent of the dry weather the mites deposit amongst litter and rubbish large numbers of aestivating or over-summering eggs. These withstand all the heat and dessiccation of the summer, hatching as soon as the atmosphere reaches a certain degree of saturation and the earth becomes well soaked. It is unfortunate that the same rains which cause the clover seed to germinate, also bring forth the mite. Most farmers, like other men, are inclined to take the line of least resistance, hence little attention is given to the initial outbreak of the pest in the autumn.

It is not until mid-June or later, that growers awaken to the fact that this pest is causing serious damage.

By this time the normal winter generations have appeared, from eggs laid upon the foliage, by the first brood mites, which issued from the over-summering eggs in the autumn. Very serious injury is done to the young clovers and other plants. This is caused by the numerous mites, which rasp the foliage and suck out the green chlorophyll matter from the young cotyleden or first leaves, put forth by the seeds. This results in the death of many seedlings, and where not actually killing, it seriously retards growth. Clovers are largely grown for early feed and any pest which prevents this causes great hardship to the animals, with consequent economic loss. As the season advances, the surviving plants will make good growth and cut-strip the mites, finally yielding a profitable crop. The loss of winter feed and the reduction of crop yield are very important factors which have to be faced.

The difficulties with regard to the measures for the control of this pest are numerous. Firstly, it has so many host plants, such as legumes, potatoes, lettuce and many other vegetables and garden plants. Wheat, fortunately, has not yet been found to suffer seriously, but oats are more subject to damaging attack. Cape weed, chick weed and other succulent weeds which grow almost on any land or road side that has been cleared, carry this mite. In the pastures the subterranean clover appears to be the favourite food.

The earth mite does not climb fruit trees or other plants which grow to any height, being confined to low-growing vegetation. It has been confused with the Bryobia Mite, which is found upon fruit trees. In any method of control adopted, it is most essential that action be taken before the winter eggs have been produced. They are normally not found until three weeks to a month after the mites have appeared in the autumn. The eggs are most

resistant to any known treatment, and the fact that they are deposited mainly upon the undersides of the foliage renders them difficult of access. It is obvious, therefore, why early action is necessary if the best control is to be obtained.

There are a number of ways in which this can be done when dealing with limited areas. Any approved sprays or dusts should be applied about two weeks after the first mites have been observed. If left later until the pest is in millions, the prospect of control is remote. The number of mites present in the early autumn is comparatively small, when compared to the myriads of which these become the progenitors as the season advances.

It has been proved by experiment that spraying or dusting with carbolic preparations is fatal to the mite. Phenyle 1 part to 70 to 80 parts of water or Izal, 1 part to 250 parts of water are both lethal.

A good carbolic dusting powder is made by mixing together thoroughly —1 lb. of 15 per cent. carbolic powder with 4 lbs. of fine superphosphate or other finely ground manure. This can be used as a miticide and top dressing manure, at the rate of 1 cwt. per acre.

The carbolic powder may be used with any other diluent, such as lime or tobacco dust, in the same proportion. The advantage of mixing it with a manure is that it serves a two-fold purpose.

Black Leaf 40 and soap used at the following strength is an effective contact spray. Black Leaf 40 1lb.. soap 3 lbs., water 70 gallons.

Another good spray is kerosene 2 gallons, soap ½ lb., napthalene ½ oz. Dissolve the napthalene in the kerosene. Shred the soap and dissolve in one gallon of boiling water. Remove from the fire and add the kero-naphthalene, churning violently for some minutes or until an emulsion is formed. This makes a stock and should be used at the rate of 1 part of stock to 8 parts of water, 1 cake of carbolic Lifebuoy soap in 2 gallons of water is effective. Dusting with Cyanogas Dust A, will destroy the mites. This powder should not be applied to moist foliage, nor when there is any wind. It is distributed per medium of a dust-gun. Powdered naphthalene dusted around plants will repel the mites. There are many other proprietary sprays which are effective.

The big question at issue in regard to this pest, is not how to kill it over a limited or small garden areas, but how to cope with it, over our large pasture lands. What can be economically done on small plots cannot be recommended over broad acres. Certain preventive measures are advised. Burning off of grass or clover lands destroys the over-summering eggs. Generally speaking, this is not possible, as the food is required to carry the stock through to the Autumn, when the young growth makes its appearance. By this time there is not sufficient dry material left to make an effective burn.

Fallowing the land every three or four years is helpful. It generally takes from three to four years after a paddock has become infested for the mite to reach plague form. By turning over the land before the grasses and

clovers have dried off, the mites will be destroyed before they have produced the resting summer eggs. The fallow should be as deep as the nature of the soil will permit and all vegetation thoroughly covered. It is well before doing so to heavily stock the paddocks to eat down the growth and at the same time to get as much benefit as possible from the food present. After ploughing, the ground should be worked down to a good tilth with a compact sub-surface. All following growths of weeds or clovers must be suppressed.

If possible land so treated should be divided from other lands by means of a ditch or drain. It has been definitely proved that the mite is readily re-introduced into a cleaned area per medium of surface running water.

Another good plan, when possible, is to leave a half chain of clear, well worked fallow all around a crop. This checks the wandering mites and also prevents reinfestation per medium of wind blown mites or their eggs.

Before again sowing to a mixed crop of oats, clovers and other suitable fodder grasses, allow a period of two weeks to elapse after the first rains. This will permit of any possible eggs to hatch in the impacted sub-surface soil, where they will die owing to being unable to reach the surface. Such treatment should give a life to the pasture of three to four years, before it will need repeating.

Another method is to allow the mites' eggs to hatch in the autumn and then turn in thoroughly before sowing the crop. Clean fallow throughout the early spring and summer will no doubt guarantee freedom from this pest at time of sowing. The trouble arises from the invasion from outside or contiguous areas. Rolling, when possible, will destroy large numbers of the mites.

The use of any manures that will assist the young seedling plants to grow more rapidly is advised. A plant which stagnates always suffers more from insect or mite attack.

The late or early sowing of crops should be tested out. For late sowing of peas it is claimed they escape the mite attack, due to the fact that the land which was fallow carried no food for the mites, which first issued in the autumn, hence they were starved out.

A fruitful source of breeding this pest is dirty or weedy headlands. This can be overcome by burning off in the spring as soon as it will carry a slow fire. One of the principal means of spreading insects and also the mite, is the use of clover seed in the burr. It is, therefore, strongly advised that only cleaned seed be used when sowing a field.

It is wise not to place all our eggs in one basket, which appears to be the case when we rely entirely upon clovers. It is necessary to try out other approved fodders which have a greater resistance to insect and mite attack. A mixed pasture is also better from an animal diatetic point of view, giving a more balanced ration.

There appears to be a feeling amongst some farmers that greater efforts should be made along the lines of biological control of the mite.

This aspect of the question has never been lost sight of. Biological control has always been a leading feature of the work of this Department, even when other States were not in harmony with this aspect of control as they are now.

In searching for the parasites or natural enemies of this pest, there are unusual difficulties to be overcome. The native home has not yet been determined and this has increased our problem enormously. The only countries in which this mite is known as an economic plant pest are Australia and South Africa.

An effort is being made to obtain this information from leading authorities of the world and the search for means of biological control is still going on.

A further difficulty is due to the fact that the mites are not insects and that generally they do not attack plant life, being mainly predators or parasites which live upon other animals or insects, or else they are scavengers. There are exceptions to this rule, however, and, unfortunately, we have introduced one of the worst.

Dr. Tillyard, Chief of the Entomological Division of the Council of Science and Industry, visited this State and in conjunction with the writer, made an inspection of several of the infested districts. He admitted with regret, that he could not see at present any practical means, biological or otherwise, in sight for the control of this pest.

There is need for fundamental research of an intensive nature into these obscure and difficult problems, and such research offers the only hope of control.

To this end it has been decided that the exclusive services of an officer of the Commonwealth Council of Science and Industry are to be made available to this State, such officer when appointed, to work in conjunction with this Department.

Having explained these difficulties, it behoves growers to take every method advised by the Department and not sit back relying upon the finding of some natural parasite.

Many insects have their peak years and then subside for several seasons, but this is not the case with the Red-legged Earth Mite; each winter it reappears in its countless millions. The only natural factors which have any checking effect are heat and lack of rain.

FALLOWING FOR FERTILITY.

1.—A STUDY OF PLOT EXPERIMENTS AT THE EXPERIMENT FARM, MERREDIN, 1928-29.

By L. J. H. TEAKLE, Plant Nutrition Officer,
and
G. H. BURVILL, Agricultural Adviser.

INTRODUCTORY.

It has long been recognised by farmers and others following agricultural pursuits that the fertility or crop producing power of a soil is dependent primarily on the nature of the soil. No very accurate definition of "nature of the soil" may be given, but it is intimately connected with the chemical composition of the soil, the content of bacteria and other micro-organisms and the presence or absence of plant poisons in active form. It seems very probable that the fertility of a soil is not generally dependent on any one factor but on the harmonious interaction of numerous factors. Indeed the soil may be likened to a very delicate and complicated machine capable of weaving the finest materials. If any one part of the mechanism is out of adjustment, the work of the whole is upset and the product is faulty. Indications of lack of adjustment are often obtainable by means of a study of such processes as nitrification or the composition of the soil solution, which are dependent directly on such factors as the nature of the soil minerals, the supply of organic matter, the micro-organisms living in the body of the soil, and the moisture available for both crop and microbial flora. The art of soil management consists in keeping the soil in a healthy condition for the production of raw materials for the benefit of succeeding crops. The engineer in charge of modern machinery and entrusted with the maintenance of mechanical adjustment is dealing with a problem less complicated and probably less difficult to manage than the soil-crop system which is being handled by the farmer.

It is only in the last century that science has been of any great assistance in the art of farming, but the results of long and careful research have revealed many of the secrets of crop growth and soil behaviour, enabling the scientist to advise the farmer regarding improvements in his technique which will result in more economical returns.

Not the least of the benefits of science in Agriculture arises from the use of improved cultural methods which affect the physical, chemical and biological factors of the soil. That is. cultivation provides a suitable seed bed and releases plant foods by stimulating the growth of desirable micro-organisms. Under conditions of high evaporation, such as apply in Western Australia, a very important result of proper cultivation is due directly and indirectly to the conservation of moisture. If the soil can be maintained at an appropriate moisture content throughout the warm summer months, both chemical and biological processes proceed at a very rapid rate and the soil solution, the very nutrient solution of the growing crop, is enriched with nitrates and sulphates and indirectly with lime, potash, magnesia and other elements. These latter elements are dissolved from the soil by the nitrates and sulphates, the products of the life processes of soil bacteria, so that more or less frequent stirring of the soil, by greatly stimulating the microbial inhabitants, leads indirectly to an increased supply of fertilising materials.

It seems, therefore, that conservation of moisture in any climate of limited rainfall and high surface evaporation or "fly-off" is of paramount importance. Cultural methods for the conservation of moisture result in—

1. Improved moisture supply for the young crop and consequently greater drought resistance;
2. Improved moisture supply for the growth of bacteria which indirectly leads to significant quantities of plant foods being rendered available for the crop;
3. Weeds being controlled and eliminated from competition with the crop for supplies of moisture and minerals;
4. Improved soil conditions whereby the plant roots develop much more vigorously and tap otherwise unavailable supplies of moisture and minerals.

For the conservation of moisture, two conditions must be observed. First, the soil must be mulched to check loss by *evaporation*. Second, the weeds must be destroyed to eliminate loss by *transpiration*. Under Western Australian conditions the mulch is prepared and restored during the process of weed eradication. This mulch provides a blanket preventing capillary movement of moisture to the surface of the soil, but will be ineffective if weeds are able to tap the subsoil moisture and dissipate it in the process of transpiration.

Studies in all parts of the world have shown that considerable quantities of moisture are saved by mulching the soil, especially under arid conditions. Experiments by Buckman (1910) in Eastern Montana showed that the following amounts of moisture, calculated as inches of rain, were stored in mulched and unmulched soils to a depth of five feet.

Mulched soil, 5 feet deep	11.1 inches of rain.
Unmulched soil, 5 feet deep	7.9 inches of rain.
Advantage of mulch	3.2 inches of rain.

In addition the mulch was effective in maintaining the surface layers in a condition relatively more moist than the subsoil layers. Thus, when the soil was considered to a depth of only two feet the following picture was obtained:—

Mulched soil 2 feet deep	5.6 inches of rain.
Unmulched soil 2 feet deep	3.4 inches of rain.
Advantage of mulch	2.2 inches of rain.

Of the moisture to a depth of five feet actually saved by mulching the soil a very large proportion, amounting to 69 per cent., was found to be in the first two feet of soil. This favourable distribution of moisture in the upper layers must greatly benefit the young crop both directly and as a result of the greater store of plant foods arising from increased bacterial activity.

From a knowledge of the wilting coefficient of the soil, that is, the economic limit to which a plant may exhaust the soil of moisture, Buckman calculated that the mulched soil contained more than twice as much available moisture as the unmulched soil and this amount would be sufficient to increase a crop by about one ton of dry matter per acre. If the wheat crop be considered, one ton of dry matter would be equivalent to about 23 cwts. of hay when allowance is made for the moisture contained in wheaten hay. This would also be equivalent to a wheat crop yielding 15-20 bushels per acre.

The effects of fallowing land were investigated in Victoria by Paterson and Scott (1912), who obtained results similar to those reported from the

Northern Hemisphere. Samples were taken from small plots on four occasions during the summer months starting October 16, 1911, and ending February 28, 1912. The soils to a depth of 18 inches were examined for moisture and nitrate nitrogen. The samples represented plots (1) fallowed and kept well mulched; (2) fallowed but not cultivated after October 16; (3) carrying an oat crop. At the end of the experiment on February 28, 1912, the cropped plot showed a deficiency of 2.64 inches of rain and the neglected fallow 2.11 inches of rain when compared with the well mulched fallow.

Interesting figures were obtained regarding the accumulation of nitrate nitrogen and are indicated in Table 1.

TABLE 1.

Nitrate nitrogen content of soil to a depth of 18 inches from plots at Sparrovale Farm, Geelong, Victoria. Figures copied from Paterson and Scott (1912).

Date.	Treatment 1—Well-mulched fallow. Nitrogen.	Treatment 2—Neglected fallow. Nitrogen.	Treatment 3—Under an Oat crop. Nitrogen.
	lbs. per acre.	lbs. per acre.	lbs. per acre.
October 16th 1911	14·0	17·6	Trace
November 28th, 1911	43·2	44·4	3·3
January 17th, 1912	123·1	60·3	28·1
February 28th, 1912	148·6	58·6	32·5

It is evident that well maintained fallow not only effects a conservation of important quantities of moisture, but also leads to the accumulation of large quantities of nitrate nitrogen. Neglected fallow, probably carrying a generous crop of weeds, is little better than cropped land with respect to moisture and nitrate nitrogen. These results compare favourably with those obtained by Teakle (1928) at the Experiment Farm, Merredin.

EXPERIMENTAL.

In the wheat belt of Western Australia it is recognised that good fallowing is synonymous with good farming. In order to obtain information relative to the effect of fallowing on the soil as well as on the crop yield, the fallowed and unfallowed plots at the Experiment Farm, Merredin, were sampled systematically and the soils analysed for moisture and nitrate nitrogen. Sampling was effected by means of a four-inch "Iwan" post hole digger and a crowbar and the soil samples forwarded to Perth for analysis in tins with close fitting lids which were vaselined to improve the seal. Nitrification was stopped by means of toluene applied in pieces of cotton wool.

Sampling the Plots.—In general, the first foot, the second foot and the third foot layers of the soil were sampled, but the toughness of the subsoil in certain instances limited the sampling to a depth of 28 inches. Where this condition applied the third foot was represented by the soil between 24 and 28 inches and such samples are indicated in the Tables. For the purposes of the experiment, two fallowed plots (plots 3 and 5) and two unfallowed plots (plots 2 and 4) only were sampled. Each plot was ten chains long and samples were taken from the middle (M), from a point about 3 chains from the North end (N) and from a point about 3 chains from the South end (S).

Samplings were made on the following dates:—November 29, 1928; February 13, 1929; March 6, 1929; April 19, 1929, August 20, 1929;

October 21, 1929, and December 11, 1929. More samplings were planned between April and August, 1929, but had to be abandoned on account of unforeseen and pressing work. However, the results show the progress of the moisture and nitrate curves until time of cropping and during the spring, when heaviest demands are made upon the soil. The August sampling was abandoned when half finished owing to rain. The October and December samplings were curtailed on account of inadequate laboratory assistance and were confined to the first and second feet only.

Soil Type.—The soil type is a red brown clay loam, originally carrying salmon gum (Euc. salmonophloia) and gimlet (Euc. salubris). It is slightly alkaline in reaction showing a pH ranging from 7.8 to 8.8. The subsoil is somewhat lighter in colour and shows a very definite accumulation of both clay and lime from a depth of about 12 inches. The soil is recognised to be of high fertility and yields excellent crops of wheat.

Laboratory Methods.—On reaching the laboratory the soils were sieved and 50-gram samples taken in duplicate for moisture determination. Four hundred gram samples were taken in duplicate for nitrate nitrogen estimations, the nitrate being extracted by the Harper method. The moist soil was well mixed by shaking with 395 millilitres (mls.) distilled water and the colloids flocculated by means of 5 mls. normal copper sulphate. The mixture was filtered on large Buchner funnels and the clear filtrate analysed by the Devarda method. The results are expressed as pounds of nitrate nitrogen per million pounds of dry soil (abbreviated p.p.m.).

Field Treatment of Plots.—The fallowed plots were ploughed in June, 1928, to a depth of four inches. They were cultivated in September by means of a springtyne, harrowed after 1.47 inches of rain in February, and cultivated in April and twice before seeding with a springtyne. The unfallowed plots were left to grass and carried a thick growth mainly of barley grass (Hordeum murinum) and burr clover (Medicago denticulata). The surface soil of these plots was well consolidated and showed a marked tendency to crack on drying out in the spring of 1928. They were ploughed early in May with a disc plough and twice cultivated with a spring tyne prior to seeding.

All plots were seeded on May 23, 1929, with 45 lbs. of seed and 120 lbs. of 22 per cent. superphosphate per acre. The variety of wheat used was Gluyas Early.

The Rainfall.—The monthly rainfall at the Experiment Farm, Merredin, during the period of the investigation is given in Table 2.

TABLE 2.

Monthly rainfall in points at Experiment Farm, Merredin, for 1928 and 1929.

Year.	Jan.	Feb.	Mar.	Apl	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total growing period.	Nov.	Dec.	Total for year.
1928 ...	39	...	101	58	76	107	224	154	71	19	651	...	24	873
1929 ...	50	162	77	...	357	309	119	94	13	35	927	220	5	1,441
Average (1910-1929)	55	56	110	71	134	177	184	134	91	75	795	44	54	1,185

The plots received very little rain in the spring and summer months of 1928 and early 1929, but the May, June and July rains were so generous in 1929 that the soil in both fallowed and unfallowed plots became well saturated with moisture in the early part of the growing season.

The Harvest Returns.—The yields of wheat, calculated as bushels per acre, obtained from the fallowed and unfallowed plots, are reported in Table 3. It must be remembered that of these plots only numbers 2, 3, 4 and 5 were included in the sampling.

TABLE 3.

Yields of wheat, calculated as bushels per acre from fallowed (Plots 1, 3 and 5). and unfallowed (Plots 2 and 4) Plots at the Experiment Farm, Merredin, 1929. (Figures kindly supplied by the Superintendent of Wheat Farms).

Treatment.	Computed Yield per Acre.					Average.	Per cent.
	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	
Fallowed	24 7	...	24 3	...	18 30	22 13	100
Unfallowed ...	...	18 4	...	14 8	...	16 6	73

The Results.—The results of the analytical work are reported in Tables 4, 5, and 6, and summarised in Tables 7 and 8. A graphical representation of the findings is afforded by Figs. 1, 2, 3, and 4.

The attention of farmers, and non-technical readers generally, is directed to figures in Table 8, where results are expressed in terms of inches of rainfall and pounds of nitrate nitrogen per acre. In addition, in this table and in Fig. 1 an attempt is made to estimate the amount of *available* moisture in the soil at the various samplings. In making these calculations it is assumed that an acre foot of soil weighs 3,750,000 lbs. or about 1,673 tons. Thus 1 per cent. moisture in the soil to a depth of one foot is equivalent to 0.168 inches of rain; one part per million (p.p.m.) of nitrate nitrogen is equivalent to 3.75 lbs. of nitrogen per acre foot. Based on the moisture content of the soil under the crop in the mulching experiment in 1928, it is also postulated that 4 per cent. moisture in the first foot and 8 per cent. in the second and third foot layers are not available for the crop. Thus the soil three feet deep must contain the equivalent of about 3.36 inches of rain before any moisture is readily available for the growing plant. These figures are based entirely on field observations and must ultimately be checked by more accurate determinations of the wilting coefficients under laboratory conditions. In the meantime the figures are very useful for judging the amount of effective moisture in the soils of this type.

TABLE 4.

The Moisture and Nitrate Nitrogen content of the first foot of Fallowed and Unfallowed Plots at the Experiment Farm, Merredin, 1929 season.

PLOT.	DATE OF SAMPLING.						
	Nov. 29th, 1928.	Feb. 13th, 1929.	Mar. 6th, 1929.	Apl. 19th, 1929.	Aug. 20th, 1929. †	Oct. 21st, 1929.	Dec. 11th, 1929.
	MOISTURE IN THE SOIL.						
Fallow—	%	%	%	%	%	%	%
3 S ...	13·2	7·9	14·2	11·3	...	6·9	12·7
5 S ...	8·4	8·4	11·6	12·1	...	7·0	9·8
3 M ...	11·3	9·7	14·9	13·8	20·0	...	11·6
5 M ...	13·0	6·7	13·1	13·7	...	...	12·6
3 N ...	10·0	9·7	12·5	13·2	16·9	5·4	11·1
5 N ...	6·2	6·5	11·6	11·7	...	5·6	11·1
Average	10·4	8·1	13·0	12·6	18·4	6·2	11·5
Non-Fallow—							
2 S ...	6·3	5·8	12·2	8·6	...	6·5	10·5
4 S ...	6·9	5·6	9·1	8·7	...	5·8	10·7
2 M ...	6·8	6·4	10·1	9·6	18·9	...	10·9
4 M ...	7·2	6·4	11·2	9·6	...	...	10·0
2 N ...	7·2	7·6	8·8	8·1	17·5	6·8	10·9
4 N ...	6·4	6·0	10·0	9·9	15·1	6·9	12·4
Average	6·8	6·3	10·2	9·1	17·2	6·5	10·9

† Sampling curtailed on account of rain.

TABLE 4—*continued.*

The Moisture and Nitrate Nitrogen content of the *first foo*. of Fallowed and Unfallowed Plots at the Experiment Farm, Merredin, 1929 season.

NITRATE NITROGEN IN THE SOIL.

PLOT.	Nov. 29th, 1928.	Feb. 13th, 1929.	Mar. 6th, 1929.	Apl. 19th, 1929.	Aug. 20th, 1929. †	Oct. 21st, 1929.	Dec. 11th, 1929.
Fallow—	ppm.	ppm.	ppm.	ppm.	ppm.	ppm.	ppm.
3 S	16·4	25·0	16·8	23·8	...	2·8	6·2
5 S	10·8	14·9	20·8	15·6	...	5·8	9·2
3 M	19·7	21·0	22·4	20·9	2·3	...	6·8
5 M	16·7	23·2	27·8	21·2	...	...	10·3
3 N	6·9	12·9	13·6	22·9	1·1	3·4	5·4
5 N	24·3	11·6	18·7	22·5	0·9	3·0	5·7
Average	15·8	18·1	20·0	21·1	1·4	3·8	7·3
Non-Fallow—							
2 S	2·0	4·4	6·1	11·7	...	1·4	6·4
4 S	1·6	5·6	15·0	11·3	...	2·7	5·3
2 M	4·3	3·7	20·8	9·2	1·4	...	7·7
4 M	2·2	4·4	14·9	15·0	...	...	11·8
2 N	1·5	4·3	9·6	10·7	0·8	1·6	5·9
4 N	2·6	3·9	14·6	66·8*	0·9	3·7	4·3
Average	2·4	4·4	13·5	11·6	1·0	2·4	6·9

* Not included in the average. † Sampling curtailed on account of rain.

TABLE 5.

The Moisture and Nitrate Nitrogen content of the *second foot* of Fallowed and Non-fallowed Plots at the Experiment Farm, Merredin, 1929 Season.

MOISTURE IN THE SOIL.

PLOT.	Nov. 29th, 1928.	Feb. 13th, 1929.	Mar. 6th, 1929.	Apl. 19th, 1929.	Aug. 20th, 1929.†	Oct. 21st, 1929.	Dec. 11th, 1929.
Fallow—	%	%	%	%	%	%	%
3 S	16·4	15·3	15·2	16·0	...	12·1	12·2
5 S	12·8	13·4	13·6	12·7	...	12·2	13·2
3 M	16·7	15·0	15·1	15·5	18·4	...	12·1
5 M	15·7	13·8	13·4	14·5	...	...	12·3
3 N	14·3	13·8	14·8	14·1	16·2	8·6	10·8
5 N	11·6	12·8	11·2	13·3	16·4	8·3	10·6
Average	14·6	14·0	13·9	14·4	17·0	10·3	11·9
Non-Fallow—							
2 S	12·2	10·6	13·0	13·2	...	9·6	12·9
4 S	10·5	10·7	10·9	10·9	...	10·4	12·1
2 M	12·1	10·2	11·7	12·0	20·4	...	11·7
4 M	12·0	10·0	11·3	11·5	...	...	11·6
2 N	11·6	8·6	11·8	10·9	20·4	10·2	11·4
4 N	10·3	10·4	11·1	11·1	15·1	10·5	11·3
Average	11·4	10·1	11·6	11·6	18·6	10·2	11·9

NITRATE NITROGEN IN THE SOIL.

PLOT.	Nov. 29th, 1928.	Feb. 13th, 1929.	Mar. 6th, 1929.	Apl. 19th, 1929.	Aug. 20th, 1929.†	Oct. 21st, 1929.	Dec. 11th, 1929.
Fallow—	ppm.	ppm.	ppm.	ppm.	ppm.	ppm.	ppm.
3 S	9·8	18·1	12·0	14·5	...	17·6	5·2
5 S	20·0	16·1	8·7	9·3	...	18·7	19·2*
3 M	19·4	12·0	12·6	14·0	15·0	...	3·9
5 M	27·0	7·5	18·8	19·7	...	...	7·2
3 N	4·0	7·5	5·0	11·4	6·7	10·8	4·1
5 N	14·3	8·1	12·0	18·1	3·4	8·7	4·3
Average	15·8	10·7	11·5	14·5	8·4	12·7	4·9
Non-Fallow—							
2 S	9·2	2·6	3·3	3·0	...	1·2	11·6
4 S	0·1	7·5	24·5*	11·0	...	8·0	3·1
2 M	9·7	3·0	9·3	4·6	3·9	...	5·4
4 M	11·1	5·0	6·9	8·8	...	...	7·3
2 N	0·8	2·7	3·6	3·1	0·3	1·5	0·9
4 N	1·2	2·2	3·3	18·2	0·9	2·5	2·5
Average	5·4	3·8	6·3	8·1	1·7	3·3	5·2

* Not included in the average. † Sampling curtailed on account of rain.

TABLE 6.

The Moisture and Nitrate Nitrogen content of the *third foot* of Fallowed and Non-Fallowed Plots at the Experiment Farm, Merredin, 1929 Season.

PLOT.	Feb. 13th, 1929.	Mar. 6th, 1929.	Apl. 19th, 1929.	Aug. 20th, 1929.*
		MOISTURE IN THE SOIL.		
Fallow—	%	%	%	%
3 S	04·1	14·6	13·8†	...
5 S	...	...	...	...
3 M	12·6	13·4†	15·3†	17·7
5 M	...	...	...	...
3 N	14·7	15·3	13·6	16·2
5 N	...	...	14·9	17·8
Average	13·8	14·4	14·4	17·2
Non-Fallow—				
2 S	10·0‡	12·7‡	13·0‡	...
4 S	...	...	...	...
2 M	11·7‡	11·9‡	12·9‡	18·5
2 M	...	...	...	...
2 N	10·0‡	14·3	10·1‡	17·4
4 N	...	...	11·4‡	17·0
Average	10·6	13·0	11·9	17·6
		NITRATE NITROGEN IN THE SOIL.		
Fallow—	ppm.	ppm.	ppm.	ppm.
3 S	14·1	27·5	11·2‡	...
5 S	...	...	...	...
3 M	14·2	15·4‡	18·7‡	25·3
5 M	...	...	...	...
3 N	12·2	5·2	13·9	22·8
5 N	...	...	23·5	12·1
Average	13·5	16·0	16·8	20·1
Non-Fallow—				
2 S	4·6‡	3·4‡	5·1‡	...
4 S	...	...	...	...
2 M	5·1‡	8·9‡	7·4‡	16·9*
4 M	...	...	...	...
2 N	2·6‡	2·9	3·9‡	0·3
4 N	...	...	13·5*, ‡	3·3
Average	4·1	5·1	5·5	1·8

* Not included in the average. † Sampling curtailed on account of rain. ‡ Sample represents soil between 24in. and 28in.

TABLE 7.

SUMMARY OF RESULTS EXPRESSED IN TABLES 4, 5, AND 6.

	Nov. 29th, 1928.	Feb. 13th, 1929.	Mar. 6th, 1929.	Apl. 19th, 1929.	Aug. 20th, 1929.*	Oct. 21st, 1929.	Dec. 11th, 1929.
				MOISTURE IN THE SOIL.			
Fallow—	%	%	%	%	%	%	%
1st foot ...	10·4	8·1	13·0	12·6	18·4	6·2	11·5
2nd foot ...	14·6	14·0	13·9	14·4	17·0	10·3	11·9
3rd foot ...	...	13·8	14·4	14·4	17·2	...	...
Non-fallow—							
1st foot ...	6·8	6·3	10·2	9·1	17·2	6·5	10·9
2nd foot ...	11·4	10·1	11·6	11·6	18·6	10·2	11·0
3rd foot ...	...	10·6	13·0	11·9	17·6	...	...
				NITRATE NITROGEN IN THE SOIL.			
Fallow—	ppm.	ppm.	ppm.	ppm.	ppm.	ppm.	ppm.
1st foot ...	15·8	18·1	20·0	21·1	1·4	3·8	7·3
2nd foot ...	15·8	10·7	11·5	14·5	8·4	12·7	4·9
3rd foot ...	...	13·5	16·0	16·8	20·1	...	...
Non-fallow—							
1st foot ...	2·4	4·4	13·5	11·6	1·0	2·4	6·9
2nd foot ...	5·4	3·8	6·8	6·1	1·7	3·3	5·2
3rd foot ...	...	4·1	5·1	5·5	1·8	...	...

* Sampling curtailed on account of rain.

TABLE 8.

Summary of results in Tables 7, expressing moisture in terms of inches of rainfall and nitrate nitrogen in terms of pounds of nitrogen per acre.

	Date of Sampling.						
	Nov. 28, 1928.	Feb. 13, 1929.	Mar. 6, 1929.	Apl. 19, 1929.	Aug. 20, 1929.*	Oct. 21, 1929.	Dec. 11, 1929.
Moisture in Soil Expressed as Rain.							
Fallow—	points.	points.	points.	points.	points.	points.	points.
1st foot	175	136	218	212	309	104	193
2nd foot	245	235	234	242	286	173	200
Total, 1st and 2nd foot	420	371	452	454	595	277	393
3rd foot	...	232	242	242	289	...	...
Total, 1st, 2nd and 3rd foot	...	603	694	696	884	...	...
Available moisture, 1st and 2nd foot	218	169	250	252	393	75	191
Available moisture, 1st, 2nd and 3rd foot	...	268	358	360	548	...	...
Non-fallow—							
1st foot	114	106	171	153	289	109	183
2nd foot	191	170	195	195	312	171	200
Total, 1st and 2nd foot	305	276	366	348	601	280	383
3rd foot	...	178	218	200	296	...	...
Total, 1st, 2nd and 3rd foot	...	454	584	548	897	...	...
Available moisture, 1st and 2nd foot	103	74	164	146	399	78	181
Available moisture 1st, 2nd and 3rd foot	...	118	248	212	561	...	...
Nitrate Nitrogen as Pounds per Acre.							
Fallow—	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1st foot	59·3	67·9	75·0	79·0	5·2	14·2	27·4
2nd foot	59·3	40·2	43·2	54·4	31·5	47·7	18·4
Total, 1st and 2nd foot	118·6	108·1	118·2	133·4	36·7	61·9	45·8
3rd foot	...	50·7	60·0	63·0	77·3	...	...
Total, 1st, 2nd and 3rd foot	...	158·8	178·2	196·4	113·9	...	...
Non-fallow—							
1st foot	9·0	16·5	50·7	43·5	5·2	9·0	25·8
2nd foot	20·2	14·2	34·8	22·8	6·4	12·4	19·5
Total, 1st and 2nd foot	29·2	30·7	85·5	66·4	11·6	21·4	45·8
3rd foot	...	15·4	19·1	20·6	6·8	...	...
Total, 1st, 2nd and 3rd foot	...	46·1	104·6	87·0	18·4	...	...

* Sampling curtailed on account of rain.

DISCUSSION OF RESULTS.

The salmon gum and gimlet type of soil as represented by the plots studied at Merredin seems to be very rich in available nitrogen, and the processes whereby nitrogen is rendered available seem to be exceptionally active. Fallowing leads to a large accumulation of nitrate nitrogen, the

form of nitrogen most readily available for crop growth, but even unfallowed land very rapidly reaches a relatively high state of fertility with respect to nitrate if rains are forthcoming. Thus, following the good rains in February, 1929, the nitrate nitrogen content of the unfallowed soils more than doubled. A dry April following led to a substantial loss of nitrates although there was no apparent loss of moisture. The loss was very probably due to the renewed activity of the other microbes which began to decompose the plant roots and other organic matter in the soil and required the nitrate as "food" for the process. The nitrate seemingly lost would find its way into the bodies of the bacteria, fungi, etc., now flourishing in the warm, moist soil and would not be available for the use of a crop until after the death of these organisms and the decomposition of their nitrogenous constituents to form nitrate again. This would probably occur during the following season.

A similar effect followed the rains in November, 1929, when the nitrate nitrogen in the soil of the fallowed plots showed a slight decrease by the December sampling. This decrease may have been associated with the absorption of nitrates by microörganisms stimulated to a greater degree of activity than were the nitrifying (nitrate producing) bacteria. The unfallowed soils, already low in nitrate as a result of the growth of the crop, responded to the November rains with an increase in the amount of nitrate nitrogen. The increase was just sufficient to bring both the fallowed and unfallowed plots to the same level of nitrates as well as moisture at the December sampling.

The effect of fallowing may be discussed under two heads:—

1.—As a means of conserving moisture.

If one considers the amount of available moisture in the first two feet of the fallowed and unfallowed plots up to the time of the April sampling, it is seen that the fallowed soil had an advantage to the extent of an average of one inch of rain, which is almost equal to the total amount (1.22 inches) available in the unfallowed soil. Very generous rains in May, June and July, 1929, fully saturated the soils in this instance so that at subsequent samplings no difference could be observed between the moisture content of the fallowed and unfallowed plots under the crop. This means that by the time of the August sampling, when the crop was about 18 inches tall and growing very vigorously, the crop on the fallowed plots must have made use of the advantage in moisture due to the fallowing.

The advantage of fallowing as a means of improving the moisture supply at Merredin in the season under review seems to have been dissipated by the exceptionally heavy early rains which benefited the unfallowed soil relatively to a greater extent than the already moist fallowed soil. It is interesting to observe further that the soil was never reduced to the limit of available water but had a reserve equivalent to about 75 points of rain in the surface two feet in October following a long dry spell. While it is not possible to decide whether this reserve was sufficient to allow adequate moisture absorption for maximum crop growth, it seems probable that, under the conditions at Merredin in that season, moisture conservation did not *directly* affect the crop yield to any great extent.

2.—As a means of affecting soil fertility.

Recent investigations in America, particularly at the New Jersey Expermient Station, have shown that nitrification (the process of forming nitrates) in the soil is a reliable index of soil fertility provided that other factors are controlled. The process of nitrification not only liberates nitrate nitrogen but leads to the decomposition of the soil minerals to render available many other elements, such as calcium (lime), potassium (potash) and magnesium, which are required by growing crops. In addition, the rapidity of the process depends on the suitability of the physical and chemical conditions in the soil. As the wheat plant requires conditions in many ways similar to those conducive to rapid nitrification, it is more than likely that soils which favour the production of nitrates will be suitable for the production of wheat.

Throughout the period of the experiment the fallowed soil was vastly superior to the unfallowed soil with respect to nitrate nitrogen. This probably means that the fallowed soil was also much better as a medium for the growth of wheat, apart from any moisture relations. No facts can be presented to indicate the underlying causes of this improvement. Whatever these contributing causes may have been, they are measured in this instance by the degree of accumulation of nitrates. It seems certain that this accumulation of nitrates was occasioned by the early effects of the fallowing on the tilth and the moisture content of the soil during the warm summer months.

That it is not simply a question of increased supplies of readily available nitrate nitrogen is suggested by the fact that ample quantities for the use of the crop were present both in the fallowed and unfallowed soils prior to seeding, and these supplies were never entirely exhausted during the growth of the crop. It has been estimated by Warington (1909) that a 30-bushel crop of wheat will require a total of 50 lbs. of nitrogen per acre. Assuming that 50 lbs. per acre were required in this case, it is evident that the plants were never in need of nitrogen. In addition, it has been found that applications of nitrogenous fertilisers, either at seeding in the autumn, or both at seeding and in the spring, do not materially improve the yield of wheat at Merredin. The results of the Nitrogen Experiment for 1929 are given in Table 9.

TABLE 9.

Yields of wheat receiving dressings of available nitrogen as sulphate of ammonia on fallowed and unfallowed plots at the Experiment Farm, Merredin. All plots were drilled on June 12th, 1929, with 45lbs. of seed and 120lbs. 22% superphosphate per acre. Certain plots then received dressings of ammonium sulphate as shown below. (Figures kindly supplied by Superintendent of Wheat Farms.)

Treatment with Ammonium Sulphate.	Unfallowed.		Fallowed.	
	Per acre.	Per cent.	Per acre.	Per cent.
	bus. lbs.		bus. lbs.	
Experiment 1, replicated 6 times—				
½ cwt. at Seeding; ½ cwt. in August	15 45	105	18 43	99
None (Control)	15 4	100	18 57	100
1 cwt at Seeding	13 21	89	18 58	100
Experiment 2, replicated 4 times—				
1 cwt. at Seeding; 1 cwt. in August	16 30	105	18 12	101
None (Control)	15 46	100	17 58	100
2 cwts. at Seeding	15 28	98	18 56	105

The fact remains that the increased yields as a result of fallowing parallel the increased accumulation of nitrate nitrogen in the fallowed plots. The increased yields are undoubtedly the result of the interaction of a large number of factors. The factors include the improved physical nature or tilth of the well cultivated soil, the better moisture condition during the summer months, and other soil conditions which are reflected in the nitrate content of the soil and the resultant harvest returns.

SUMMARY AND CONCLUSIONS.

The fallowed and unfallowed plots at the Experiment Farm, Merredin, were sampled systematically from November, 1928, to December, 1929, and the soils examined for moisture and nitrate nitrogen contents.

The prevailing soil was a red brown clay loam representing the type usually carrying salmon gum and gimlet in the virgin state.

Two plots represented each of the conditions of fallow and non-fallow, and each plot was sampled at three sites, usually to a depth of three feet.

The results of analyses are reported in the tables and in the form of curves. A study of these results in the light of plot yields leads to the following conclusions regarding this type of soil in the Merredin district:—

1. Fallowing leads to a substantial accumulation of nitrate nitrogen and conservation of moisture as well as improved harvest returns.

2. In April, 1929, the fallowed plots contained nearly 110 lbs. more nitrate nitrogen per acre three feet deep than did corresponding unfallowed plots. This is equivalent to 550 lbs. of sulphate of ammonia or 710 lbs. of nitrate of soda.

3. In April, the fallowed plots contained a greater amount of moisture than did the corresponding unfallowed plots. This advantage was equivalent to nearly 1.50 inches of rain distributed through the soil to a depth of three feet.

4. The fallowed plots (3) gave an average yield of 22 bus. 13 lbs. per acre while the unfallowed plots (2) yielded only 16 bus. 6 lbs. per acre or 73 per cent. of the yield on the fallowed plots.

5. The enormous increase of nitrate nitrogen in the fallowed plots is due to the favourable tilth of the soil and the improved moisture conditions during the summer and autumn months.

6. Exceptionally heavy rains in May, June, and July, 1929, eliminated detectable differences in the moisture content of the plots under test whether fallowed or unfallowed. Under these conditions the substantial advantage in yield of the fallowed plots, amounting to over 6 bushels per acre, seems associated rather with other benefits accompanying the cutivation of the soil during the spring, than directly with the conservation of moisture. The satisfactory soil tilth and higher moisture content during the summer months favoured the activity of beneficial bacteria, as shown by the large accumulation of nitrate nitrogen.

7. The crop yields show that this soil condition proved more favourable for the growth of wheat as well as for desirable bacteria.

8. While in a dry season, or in dry districts, the advantage of fallow is intimately associated with the amount of moisture conserved, in favourable seasons the advantage seems more intimately associated with more subtle factors such as soil tilth and the nature of the soil solution as affected by the summer activity of micro organisms.

ACKNOWLEDGMENT.

The thanks of the authors are tendered to Professor Paterson, of the University of Western Australia, who kindly made available his laboratory and facilities for this work.

Thanks are due also to the staff on the Experiment Farm, Merredin, and in Head Office, who willingly co-operated to make it possible to continue with a considerable amount of the work during the absence of the senior author. We wish specially to acknowledge the help of Mr. N. Davenport, who took charge of the sampling carried out in October.

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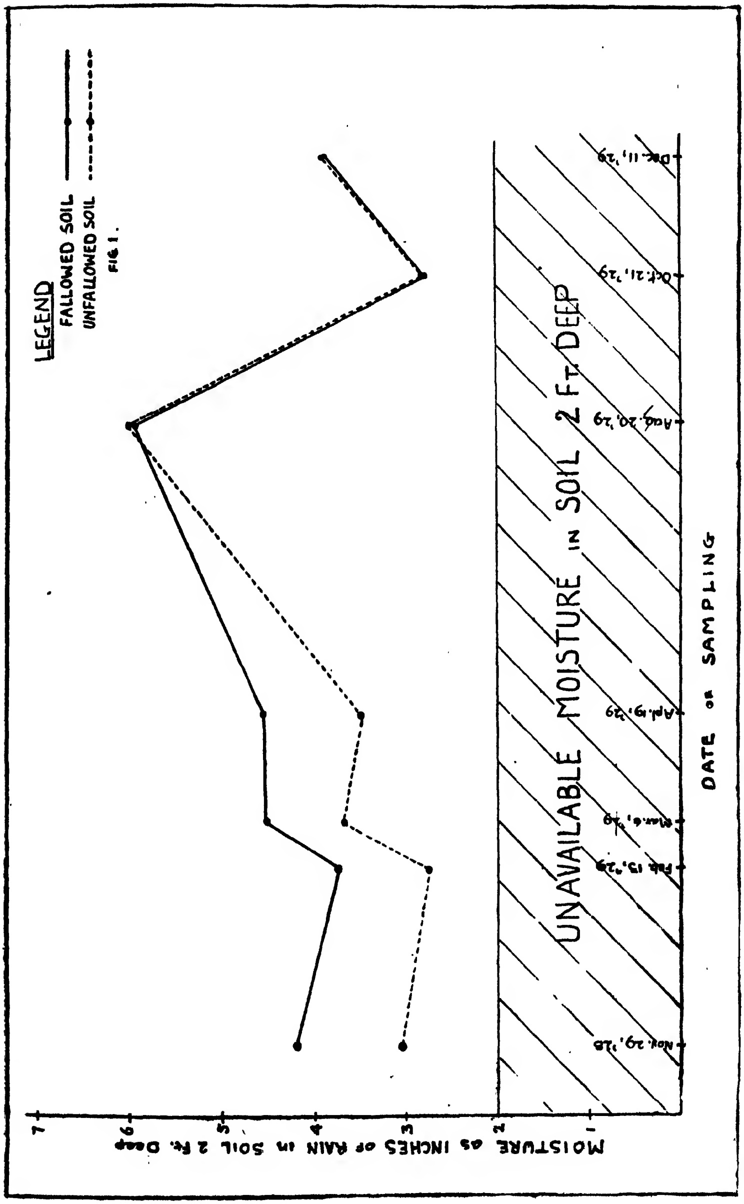


Fig. 1.—The value of fallow as compared with non-fallow, in terms of rainfall stored in the soil at the Experiment Farm, Merredin, to a depth of two feet.

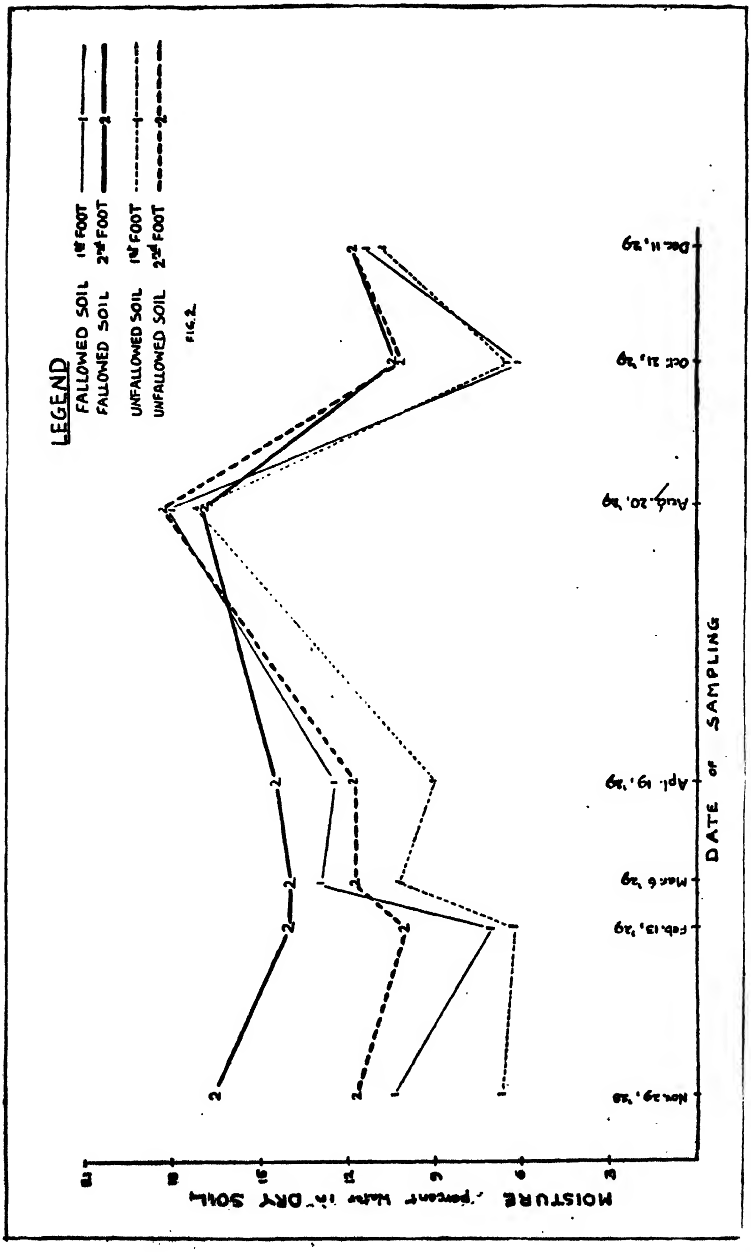


Fig. 2.—Fluctuations in moisture contents of fallowed and unfallowed soils to a depth of two feet at Experiment Farm, Merredin. The plots were sown May 23rd, 1929, with 45 lbs. Gluyas Early and 120 lbs. superphosphate per acre.

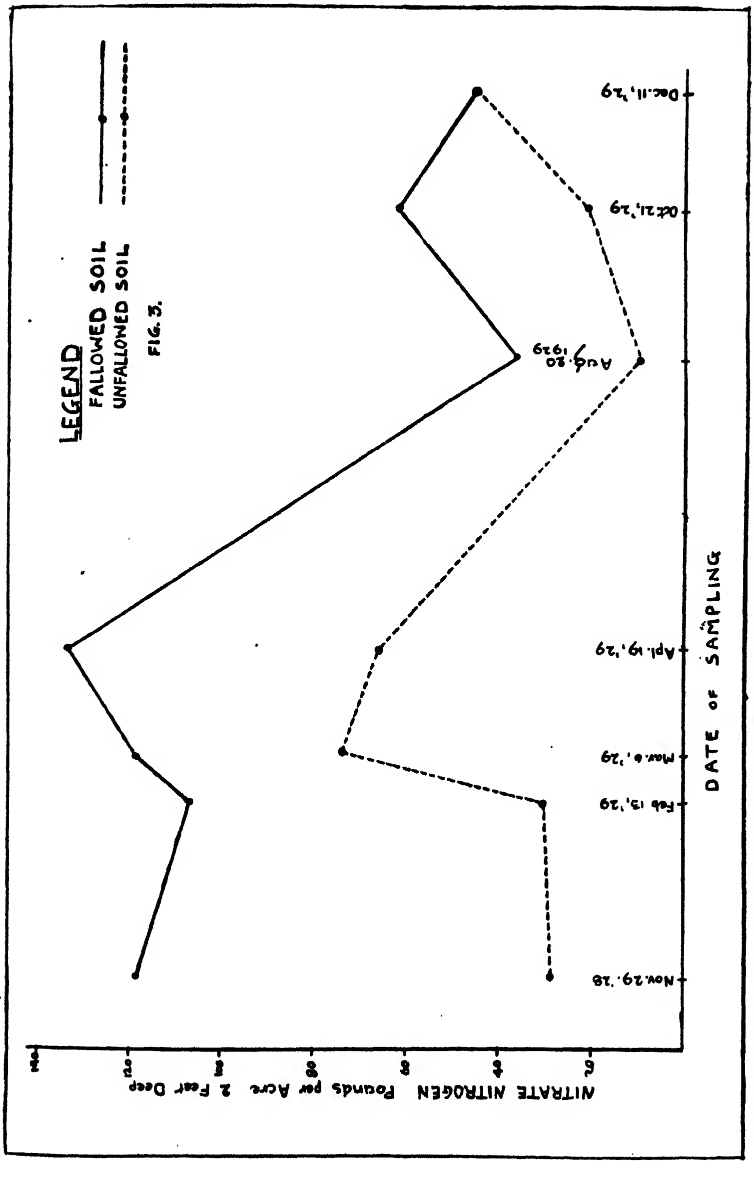


Fig. 3.—The value of fallow as compared with non-fallow, in terms of nitrate nitrogen in the surface two feet of soil at the Experiment Farm, Merredin.

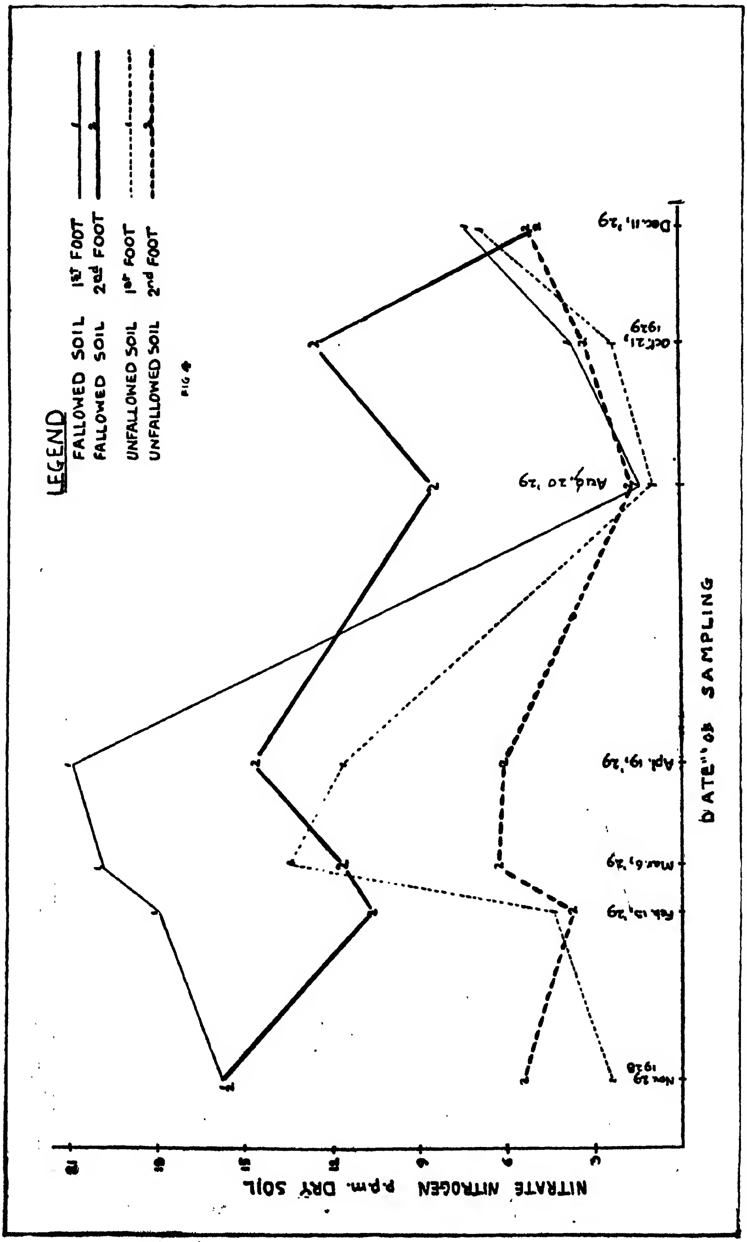


Fig. 4.—Fluctuations in nitrate nitrogen contents of fallowed and unfallowed soils to a depth of two feet at Experiment Farm, Merredin. The plots were sown May 23rd, 1929, with 45 lbs. Gluyas Early and 120 lbs. superphosphate per acre.

THE BEST KEPT FARM COMPETITION.

MANJIMUP.

M. CULLITY,
Agricultural Adviser, Dairy Branch.

This competition was made possible by the generosity of the Hon. Edwin Rose, M.L.C., who provided a Cup for competition among the dairy farmers of the Manjimup district.

The local Agricultural Society has been instrumental in organising and arranging the competition. All settlers in the Manjimup and Pemberton districts being eligible to compete.

This is the second such competition to be organised in this district. The previous one, which the writer also had the honour of judging, was organised by the Jardee Settlers' Association in 1927.

The following scale of points were adopted. This being identical with the scale used in a recent competition in the Harvey District.

Farm Stock (preference given to Dairy Stock of the Zone Type)	50
Pastures	40
Supplementary Fodder Crops	30
Conservation of Fodder	30
Farm Buildings and General Lay-out, including Fencing	35
Farm Implements and Dairy Utensils	15
Total Points	200

Sixteen entries were received and the properties covered a wide stretch of country. From Mr. W. Green's Farm, on Group 23, Manjimup, to Mr. J. South, Group 2, Fly Brook, Pemberton, is approximately 45 miles.

It is to be regretted that some of the older residents did not see fit to enter their farms. All the entries that were received were from farmers making their start as group settlers. This fact, to an extent made judging a little difficult. All these farms, with the exception of Mr. Egginton's, were established at the same time. The same style of buildings, fences, and systems of layout, were adopted in all cases, and judging had to take into account the neatness with which work was executed, to distinguish between farms.

Mr. Eggington's farm has not been included in this scale of points. This settler has not been on his holding as long as the other entrants, and naturally his farm has not yet reached the same degree of development. Mr. Eggington has one cow only, this, of course, for his home. His farm generally gives one an impression of painstaking effort to achieve the degree of neatness and cleanliness that prevails. In a year or two, when his pastures have hardened and are carrying stock, this farmer will have to be reckoned with in any similar competition.

The following is a list of the competitors, with the areas laid down to pastures and crops.

Name.	Area in Pasture.	Area in Crops.	Address.
	Acres.	Acres.	
Nicol, R.	...	5	Group 19, Manjimup.
Green, W.	50	19	Group 23, Manjimup.
Murdock, P. G.	37	18	Group 31, Jardee.
Kjellgren, W.	37	25	Group 31, Jardee.
Wirth, A, ...	40	27	Group 21, Jardee.
Griffiths, W.	...	10	Group 8, Pemberton.
Hunter, D.	55	23	Group 8, Pemberton.
Kjellgren, A. ;	72	19	Group 31, Jardee.
Underwood, S.	80	23	Group 5, Manjimup.
Bailey, T.	54	14	Group 21, Jardee.
Nelson, C.	70	9	Group 21, Jardee.
Haig, R.	40	5	Group 21, Jardee.
Saunders, D.	70	8	Group 25, Jardee.
South, J.	26	9	Group 2, Pemberton.
Goulden, H.	28	22	Group 21, Jardee.

Included in cropping are self-sown oat crops.

The points allotted at each farm follow in table form. From this it will be seen the first three competitors are as follows:—

A. Kjellgren .. .. 178 Points.
D. Hunter .. .. 174 „
W. Kjellgren .. .. 172 „

Scale of Points.

Name.	Stock.	Pasture.	Supplementary Fodder Crops.	Conservation of Fodder.	Buildings, Fencings, etc.	Implements and Dairy Utensils.	Total.
Kjellgren, A. ...	46	37	30	16	34	15	178
Hunter, D. ...	42	32	35	18	33	14	174
Kjellgren, W. ...	47	35	33	18	28	11	172
Murdock, P. G. ...	40	34	22	26	31	13	166
Griffiths, W. ...	43	37	28	18	27	12	165
Wirth, A.	40	34	22	18	31	15	160
Bailey, T.	50	36	14	16	31	11	158
Nucol, R.	48	37	5	30	26	10	156
Underwood, S. ...	41	31	30	16	24	12	154
South, J.	46	33	17	16	24	10	146
Nelson, C.	42	35	10	16	23	9	145
Goulden, H. ...	45	32	15	10	24	11	137
Saunders, D. ...	43	38	10	14	22	8	135
Green, W.	40	30	17	...	26	10	123
Haig, R.	41	36	5	7	22	8	119

BULLS IN USE.

As all the competitors are on group holdings, the bulls conformed to the zone breed (Guernsey). Ten of the competitors are owners of bulls and a perusal of their pedigree gives one an idea of the type of animal being used.

Name of Owner.	Name of Bull.	Production of Bull's Dam.
Hunter, D.	Denmark Faithful Chief (Reserve Champion, Perth R.A. Show, 1929)	407lbs. fat.
Nelson, C.	Robin of Nundorah (Champion, Perth R.A. Show, 1929)	400·96 lbs. fat.
	Minnamurra Prairie Don	442 lbs. fat.
Nicol, R.	Denmark Favourite Chief	407 lbs. fat.
Griffiths, W.	Koojan Moses	410 lbs. fat.
Kjellgren, W.	Minnamurra Handsome Bay ...	360·78 lbs. fat.
Kjellgren, W.	Minnamurra Hector	221·0 lbs. fat.
Bailey, T.	Minnamurra Valentine (1st Prize, Novice Class, Perth R.A. Show, 1929)	233·51 lbs. fat.
South, J.	Minnamurra Charter	320 lbs. fat.
Wirth, A.	Roland of Koojan	251 lbs. fat.
Underwood, S.	Muresk Priam	242·44 lbs. fat.

DAIRY COWS.

In practically all cases, the stock inspected were in good condition, but in one or two instances, odd cows were low in condition, while in some herds the provision of a stock lick would have done the little necessary to have gained full points.

Here, again, the effect of the pure bred herd bulls may be seen. Below in Table 4 will be seen an analysis of the stock on the farms, the number of first-cross cows in profit, and the number of younger animals coming on. I must make special mention of the foresight of Mr. R. Nicol in obtaining a number of grade heifers when opportunity offered about eighteen months ago. To-day Mr. Nicol's position is that, of a total number of 28 cows in milk, sixteen are first-cross heifers, and of a total number of fifty-five head of cows, heifers, and calves, there are forty two-grade Guernseys.

A perusal of the table below will give some idea of the extent to which grade heifers will become available.

Name.	Total Cows. Heifers and Calves.	Total Cows in Milk.	Guernsey Grade.			
			Cows in Milk.	Heifers.	Calves.	Total.
Nicol, R.	55	28	16	14	12	42
Nelson, C.	25	15	3	...	6	9
Kjellgren, A.	22	12	5	...	7	12
Kjellgren, W.	27	16	5	4	6	15
Goulden, H.	26	14	1	5	6	12
Bailey, T.	20	10	4	2	7	13
Haig, R.	12	7	1	...	3	4
Wirth, A.	21	15	1	2	2	5
Murdock, P. G.	18	10	1	3	5	9
Saunders, D.	21	13	3	4	2	9
Griffiths, W.	27	12	2	6	3	11
Hunter, D.	27	16	3	3	6	12
Underwood, S.	34	25	1	6	2	9
outh, J.	16	9	2	4	2	8

The value of the Zone System of dairy herd improvement will be demonstrated in an even more convincing manner as time goes on. When herds, where continuous use of one breed of bull has been made, are compared with those where the breed has been frequently changed, the demonstration is complete.

The rearing of calves does not present any difficulty to any of the competitors. Through the wise policy of avoiding over-stocking, sufficient run is available for the young stock. The existence of a close market for cream, ensures the separation of the milk at home and the utilisation of the skim for the feeding of calves and pigs. In all cases the rearing of the young stock reflects great credit on the competitors.

PIGS.

As yet, this adjunct to the running of milch cows is not receiving the attention it warrants. The absence of whole milk depôts and cheese factories means that the farmer has his skim milk for feeding. While the majority of the competitors have one brood sow or more, one or two have not any, and as a consequence are losing a sum which in their circumstances may be called considerable. Even where brood sows are kept, the treatment and housing is not what is desired. Messrs. Bailey, Hunter, and Green show the way in this respect. Proper shelters should be erected, and farmers should remember that pigs are essentially clean animals. Where paddocks are sub-divided, so that the pigs may be changed around, allowing the shelters to sweeten and providing the pigs with pasturage, best results follow.

Where pigs are confined to sties, insanitary conditions are likely to arise, and in the winter months as often as not, the sties become sloppy, thus making conditions favourable for an outbreak of pneumonia. Further, to this, sloppy, insanitary sties are a source of danger to the people who have to work near, or in them.

PASTURES AND CROPS.

A good pasture will contain a mixture of grasses and clovers. Luxuriant growths of sub-clover were inspected on each holding. Only to a small extent in a few paddocks was there any sign of a mixed pasture. Mr. A. Kjellgren's flat in the front of his house, being an example of this, in fact, is a good example to the other competitors in the utilisation of flats not being used for cropping. This flat, though small, carries Mr. Kjellgren's stock for a great part of the summer. Some small shade trees are appreciated by the cattle, as is the permanent stream of running water.

Subterranean Clover forms the bulk of the herbage and is gradually crowding out the smaller clovers and grasses. Where this is so, the weeds in the pastures, ferns, dandelions, scotch thistle, etc., receive attention from the stock.

Some good examples of sowing on the burn were seen, particularly that on Mr. W. Griffiths' property, Group 8, Pemberton. Here ten pounds of clean seed was sown and was top-dressed with two and half hundredweight of super. in two dressings. This now is covering all the ground. The total cost to bring it to this stage was only £3 per acre, as against £15 to £20 under the old system. A point of interest here was a section sown on the burn, but seeded with Subterranean in the burr. One and a-half bags per acre of burr were used. Here the result, though good, was not nearly equal to where clean seed was used. A bag of burr will contain from five to twenty pounds of clean seed. So that one can see the comparisons of burr

against clean seed are not fair unless the seed content of the burr is known. Bearing this in mind, farmers are warned against buying in the burr, as the variable seed content, weed seeds are spread with eggs of the Lucerne flea, and the red-legged velvet earth mite.

To provide a change from clover one competitor, Mr. W. Kjellgren, followed a wise course. About twenty-two acres of oats were sown and all has been grazed. Mr. Kjellgren knew when he was sowing about how much he would require to cut for hay (about eleven acres) so that he has been able to graze eleven acres the whole season, so giving his cows in these paddocks a mixture of oats and clover. In all cases top-dressing with super. in the autumn was carried out and in some cases a second spring top-dressing was given.

The main winter crop, supplementary to the Subterranean Clover was oats. About fifteen acres being sown on an average on each farm. Two small crops of wheat were sown; five acres of Canberra by Mr. A. Kjellgren was sown very late, and will not yield a big crop; five acres of Nabawa by Mr. R. Nicol, was a very fine crop and will return a good cutting of hay.

Lucerne is not receiving the attention it warrants. This crop has been proved to be a reliable one, providing the farmer gives it reasonable care. In all twenty acres are being utilised by competitors for this crop.

Other crops to receive attention were rape by Mr. W. Green, for his pigs; barley for early feed, by Messrs. Wirth, Hunter, and Murdock; turnips and sweeds by Messrs. Wirth, Nelson, and Saunders.

All were preparing land for summer crops, maize, Sudan grass, millet and mangolds. The necessity for early cultivation of these crops should be stressed. The resultant conservation of moisture achieved by early and thorough cultivation will often mean the difference between success and failure.

CONSERVATION OF FODDER.

On each holding was inspected varying quantities of hay, lucerne, clover, and oats, being utilised for this purpose by farmers. Here one may stress again the advantages of lucerne in as much as this crop gives green feed, when it is most needed and can be cut for hay when clovers and grasses are abundant. Some excellent hay was seen, particularly the clover hay of Mr. P. G. Murdock. This was beautifully made, little leaf being lost, and an excellent colour and aroma being achieved. With reference to this one might stress the importance of getting the clover hay into the stack quickly, or if carting in has to be delayed owing to pressure of work, then the importance of making large cocks in the field. Where the clover lies out in windrows in the usual hay-cutting weather, the material becomes bleached and brittle. This applies also to the material when it is made into small cocks. In good weather clover hay can be in the sheds in three days.

As a general rule, the oat crops are cut much too late. In fact, the crops are almost ready for threshing, so that the stalks are little better than straw, and much grain is lost in handling.

BUILDINGS AND GENERAL LAYOUT AND FENCING.

In this section thirteen of the fifteen competitors have buildings conforming to the same pattern. The two differing being the first two prize winners. Mr. Kjellgren has the regulation group milking shed, hay shed and dairy, but these he has had erected with a view to neatness and ease in working. Extra to this he has erected a two-storey barn. The upper storey being a

hay loft, whilst the lower is cart and machinery shed and stables. Mr. Kjellgren's buildings are also conspicuous for the cleanliness of their surroundings. Mr. D. Hunter has a regulation shed which he does not use, but has erected another longer building with a loose box for his bull. His stables and hay shed are separate. All are strongly built and are neat.

DAIRIES.

Settlers must remember that the quality of the butter made in our factories is influenced primarily on the farms. It is impossible for the most up-to-date machinery to make a high grade article if the farmer is neglectful and dirty. With the handling of milk and cream too much care can never be taken. Because only a small number of points were allotted for dairies, settlers must not look upon this side of the farm as of little importance.

During my inspections two dairies stood out above the others; these were those under the supervision of Mrs. A. Kjellgren and Mrs. Wirth, and both ladies are to be complimented on the high standard attained.

One aspect of the competition to which consideration was given, although it was not actually listed separately, was the matter of water for stock. This was included in the section "Layout." The provision of water, particularly during the summer time, is of utmost importance to all stock and in particular milking stock.

GENERAL REMARKS AND CONCLUSION.

During the visits of inspection I was very pleased to note the friendly rivalry that was apparent and also the endeavour to excel and improve. If all such competitions are as fortunate in the entrants, then the task of the judge is made so much easier.

One or two points may be noted before concluding.

(1) *Pastures.*—Farmers should endeavour to encourage the growth of grasses and not rely on sub. clover only. They may sow more oats than they require to cut for hay, or Perennial and Wimmera rye grasses and Cocksfoot with their oats, or may broadcast the grass seeds on a field cultivated in early autumn.

(2) *Sowing of Oats and Barley for Early Autumn Feed.*—For early feeds, Burt's Early or Mulga Oats will be found to give good results if sown in time to germinate with the early rains.

(3) *Cutting of Hay and Silage at the proper time and Curing Correctly, where Silage is being made.*—See that it is made without encroaching on to the hay-cutting season. Silage cannot be made profitably if the crop is ready for hay cutting.

(4) *Early and thorough Cultivation for Summer Crops.*—Early and thorough cultivation for summer crops will mean that the crops start away well and that sufficient moisture will be held in the soil to ensure a good crop.

(5) More attention can be directed to pig raising and the smaller side lines, potato growing, vegetables, if only for home use. The provision of a few fruit trees for the home.

(6) Shelter should be arranged for stock for both summer and winter. The stock will appreciate it and pay for it.

In conclusion, I wish to express my thanks to the competitors for the ready way they have met me with what information was desired and other courtesies extended.

INTERIM REPORT ON THE PROTECTION OF YOUNG CITRUS TREES FROM FROST.

E. R. WEST, Griffiths Research Station, N.S.W.

(Courtesy of the Council of Scientific and Industrial Research.)

During the winter of the year 1929 an experiment was carried out to test various methods of frost protection for young citrus trees. Owing to the great individual variation in the susceptibility to frost of trees treated in any one particular way, the results were in some respects indefinite; nevertheless, results were obtained which seem of sufficient importance to record.

Continued low temperatures or very severe frosts will kill citrus trees; on the other hand, good commercial fruits are not grown in the tropics, so that commercial citrus growing is limited to more or less subtropical regions, which, as a general rule, are subject to frosts during the winter. Should these frosts be severe, damage will be done either to the fruit or tree. Comparatively severe frosts will destroy the fruit, and very severe frosts will defoliate the mature tree, and may even kill the main branches. The only known practicable method of preventing such damage is by orchard-heating, but this method is so expensive as to render it doubtful whether such expenditure is profitable. If the chances for the occurrence of many frosts of such intensity are very great, the locality should be considered unsuited to citrus culture. Young citrus trees are very much more susceptible to frost than old trees, and frosts that do no damage to either the fruit or foliage of old trees may completely kill young trees. In almost all citrus-growing districts, during some seasons at least, frosts serious enough to damage young trees occur, so that a method of treatment that will prevent or lessen the risk of frost damage to young trees, other than orchard-heating, which is too expensive, would be of great value.

Many methods of protecting plants from frost are in common use. Methods that depend on covering the plant with an insulating material, or with a screening material, are suitable for young citrus trees. They include—

(1) Smudge fires that will cover the orchard with a dense smoke screen, which will intercept the radiant heat given off by the plants and the soil on a frosty night. Such fires are not to be confused with fires used in orchard-heating, that are sufficiently numerous to actually warm the air, and in this way keep up the temperature without the creation of a smoke-screen. Sufficient evidence has not been adduced to show that smudge fires are of any use at all in frost protection, and reliable opinions now deny any benefit due to a smudge (1), so that the use of smudge fires need be considered no further.

(2) Covering part or the whole of the tree with straw, hessian, or some such material. Some protection from frosts should be expected from such treatment. The question arises as to the most efficacious method of covering the tree, and the de-

(1) Hume, H. H. (1926). The Cultivation of Citrus Fruits, p. 337, Macmillan & Co.

insulating materials retarding the conduction of heat from the tree to the colder exposed surface.

The effects of the mounding with soil were interesting. Table 1 shows that ten out of a total of seventeen trees had their branches destroyed, but the main stems protected by the soil survived. It was noticed that, almost without exception, where soil was mounded up around the stem, the bark was destroyed just where the stem emerged from the soil, but a few inches below the soil the stem was quite healthy. It appeared that the injury at this part was more severe and more general than in the other treatments where no soil was mounded up. It would, therefore, appear that mounding up with soil is a very sure protection against frost for that part of the tree covered with a few inches of soil, but greatly increases the liability to frost of that part emerging from the soil. It is well known that the most susceptible part of the citrus tree to frost is the union of the scion and stock. This has always been explained by the assumption that the union is a naturally weak part of the tree. May it not be that frost injury is greatest at this part, because under ordinary conditions it is near the surface of the ground?

It is evident that placing a hessian sack over the tree is in some way injurious, as trees treated in this way suffered more damage from frost than unprotected trees. The hessian bent the foliage over, and probably gave very little protection to much of the foliage, as the twigs were pressed against the hessian which was coated with frost crystals on frosty nights. It is possible that a hessian screen supported on framework over the trees in such a way that the hessian does not come into contact with the foliage may give better results; but such an arrangement, even if found to be satisfactory, would probably be too expensive. Although not apparent from the results summarised in Table II. the tarred hessian was even more injurious than the untreated hessian, as it was noticed that the foliage died much sooner under the tarred hessian. This may have been due either to the more complete shading or to a direct chemical injury. Trees completely enveloped in straw appeared to gain some measure of protection, but as only nine two-year old trees were used in this treatment, no great reliance can be placed on the results.

It is possible that in the case of most protective coverings, the final effect is, broadly, the result of two opposing factors. Checking the falling in temperature of the tissues of the tree is a beneficial factor, while interference with photosynthesis, aeration, and other processes is a detrimental factor, inasmuch as a certain weakening of the tree results, and it would appear from observation that a tree in any way weakened, such as by partial wilting, presence of excess salt in the soil, or by poor nutrition, or mechanical injury, is more susceptible to frost injury; so that the amount of benefit or otherwise that any protection affords is dependent on the relative intensities of these two factors. It has been noticed also that tissue which seemed quite healthy when coverings were removed, died later after exposure. This point, however, requires further investigation. In this connection Hume (4) advises against completely burying the tree in soil on account of the resultant injury.

It cannot be said that these results are as yet very conclusive. It is evident that where only small differences exist a very much larger number of trees should be used than were here available. It is hoped to repeat similar trials in the future; but certain difficulties exist.

(4) Hume—*loc. cit.*

Firstly, an orchard having recently planted uniform trees, and situated on level land free from any influences likely to cause differences in frost liability in different parts of the orchard, is required, and such an orchard is very difficult to find.

Secondly, the success of the trial will depend on whether frosts sufficiently severe to do much damage occur, and after all, the chances are of course against this in a citrus-growing district.

SUMMARY.

A trial was made of different methods of protecting young orange trees from frost. It appeared that—

(1) wrapping a few thicknesses of paper round the stem gave very effective protection;

(2) mounding soil up round the stem was effective protection to the stem, but increased the injury to the branches;

(3) protecting the stem with a cylindrical wire-netting frame 3in. in diameter covered with hessian was less effective;

(4) placing a hessian bag either tarred or not tarred over the tree was distinctly detrimental.

It is felt, however, that further trials could be carried out with advantage.

TABLE I.

Age of Tree when Planted.	Dead. years. 1	2	3	Dead to Bud Union. years. 1	2	3	Stem Alive. years. 1	2	3	Unaffected. years. 1	2	3	Total.
1.—No Protection	3	3	3	0	2	0	0	1	0	0	5	0	17
2.—Hessian over Wire ...	3	1	0	0	2	0		...		2	8	1	17
3.—Paper round Stem ...	1	1	0	0	1	0		...		0	12	1	16
4.—Mound of Soil	0	0	1	1	1	0	2	8	0	0	4	0	17
5.—Hessian over Tree... ...	1	8	0	2	5	0		...		0	1	0	17
6.—Tarred Hessian over Tree ...	2	7	2	0	3	1	0	2	0		...		17
7.—Straw over Tree	5	3	0		...		0	2	1	0	4	1	16
Total	15	23	6	3	14	1	2	13	1	2	34	3	117

——	Dead to Union.	Stem Alive.	Number.
	Proportion of Total.		
No Treatment	·5	·5	11
Hessian over Wire	·3	·7	11
Paper round stem	·1	·9	14
Mound of Soil	·1	·9	13
Hessian over Tree	·9	·1	14
Tarred Hessian over Tree	·8	·2	12
Straw over Tree	·3	·7	9

THE BACON PIG.

G. K. BARON-HAY,
Superintendent of Dairying.

In closely settled areas where dairying is carried on as the principal source of revenue, the rearing and fattening of pigs should prove a profitable sideline.

While specialised pig farms do exist on which large herds of pigs are kept, the general rule is for pig-keeping to be associated with some other type of farming. This point was particularly stressed by the Imperial Economic Committee when submitting their report on Pigs and Pig Products within the Empire last year.

This fact is specially of value in Western Australia to-day. in view of the efforts being made to develop the extreme South-West portion of the State.

Since the inception of the Group Settlement Scheme, some 1,750 dairy farms have been created, in addition to private settlement which is not inconsiderable. The problem of stocking this large number of holdings with dairy cattle has been difficult. It has proved quicker to produce new areas of pasture and to grow fodder crops than to breed the necessary dairy cattle to consume this pasture. In the opinion of the writer, dairy farmers, especially those recently established, must look for other sources of revenue—in addition to butter-fat production and other means than through milch cows—to transform green fodder into marketable products.

The two primary products for which there is a ready market in this State to-day are:—

1. Milk products—butter, cheese, etc.
2. Pig products—pork, ham, bacon, etc.

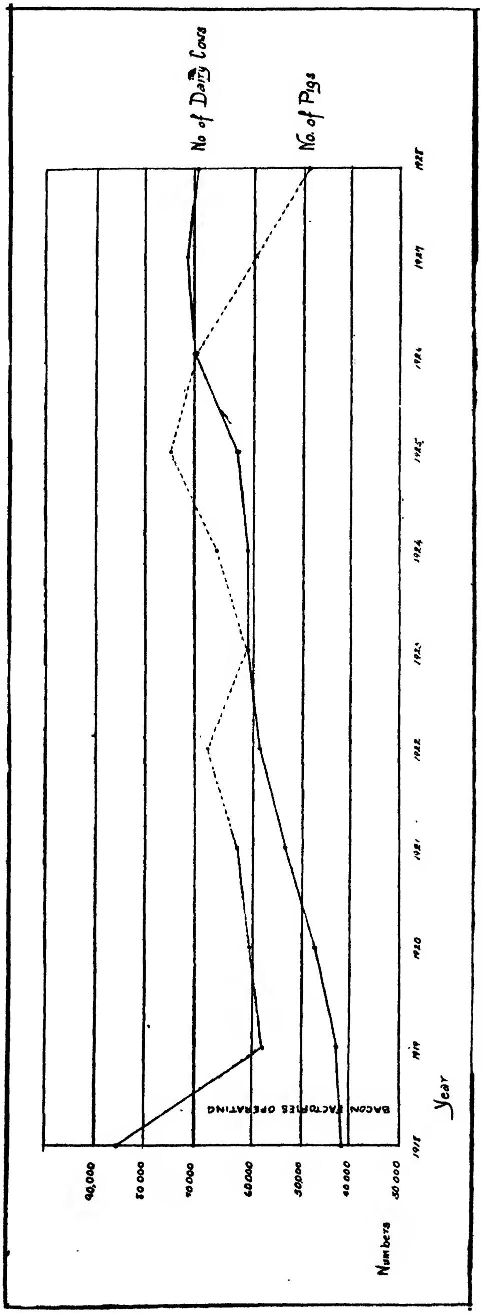
The following table shows local market for pig products.

	1924-25.	1925-26.	1926-27.	1927-38.	1928-29.
	£	£	£	£	£
Consumption	356,426	402,877	300,438	341,835	358,273
Production	137,221	227,405	133,770	147,473	132,400
Local market available ..	219,205	175,172	166,668	194,362	225,873

Pig farming has not progressed in Western Australia commensurate with the increase in dairy cattle, or with the development of the South-West portion of the State.

From the accompanying graph it is seen that the number of pigs has fluctuated greatly from year to year, but has remained on the average constant, while the number of dairy cows has shown a continued increase.

This rapid fluctuation of the pig population is in itself an argument in favour of developing the pig industry, indicating as it does the capacity of



Graph showing relative changes in numbers of Pigs and Dairy Cattle, 1918-1928.

the pig above all other farm animals for rapid reproduction. The cow is only able to increase at a very slow rate in comparison, as is shown in the following table:—

	Annual Increase. Per cent.
Cattle	80-90
Sheep	95-115
Pigs	1200-1800

Several reasons are advanced for the apparent unpopularity of the pig industry:—

1. Fluctuation in the prices of pig products.
2. Fluctuation in prices of feedstuffs, being an indirect cause of 3.
3. The change of pig population from the Wheat Belt to the dairying districts of the State.
4. Disease.

1. *Fluctuation in the price of pig products* is not a local phenomena, but is apparently a feature of the world trade in these products. In European countries an attempt has been made to work out a definite periodicity curve for the prices of pig products, and investigations* have shown that a definite "cycle" can be observed between high prices and low production and low prices and high production. These "cycles" vary from three to four years. This fluctuation is ascribed tentatively to rapid over-production, causing a fall in price, and as rapid a fall in production consequent on dissatisfaction with the low prices, causing a scarcity and consequent rise in price. Owing to the rapidity with which the number of pigs can be increased, the whole "cycle" takes approximately four years.

However, at present this condition of affairs does not occur as far as this State is concerned, as a local market for pig products exists of approximately £225,000, which market is continually increasing.

2. *Fluctuations in prices of foodstuffs.* Suggestions have been made that periodical fluctuations in the pig population have been caused by the price of the main feeding stuffs, in this State wheat or its products. This may to a certain extent be true, but an elaborate examination in Germany into the prices of foodstuffs and the stocks of pigs discounts the theory that there is a close association between the "cycle" of pig production and the prices of foodstuffs.

On only a few farms in this State has an attempt been made to provide the majority of foods required for the production of bacon, and these farms are more or less free from the effects of fluctuations in the prices of foodstuffs, particularly pollard, which, in the Dairy Belt, has been the main concentrate fed to pigs. This subject will be dealt with at a later date in this Journal.

3. *One effect of the high price of wheat,* which has ruled until recently, has been the transference of the pig population from the Wheat Belt area to the Dairy Belt. Wheat farmers have found it as profitable to sell any "seconds" or "cracked" wheat on the local market to feeders, and so avoid the labour entailed in feeding pigs. With the rapid development of the Dairy Belt, increasing numbers of pigs are being bred on dairy farms, and it is to the South-West that bacon factories must in the future look for their supplies.

* "Pigs and Pig Products, 1929," Report of Imperial Economic Committee.

4. *Disease* has been advanced as a reason for the fluctuations in our pig population, but this State has been remarkably free from serious disease during the period under review. The outbreak of swine plague in 1927, though causing a great deal of inconvenience to farmers in the affected area, caused a depletion of not more than 2,000 head of pigs. This outbreak, through creating a fear of disease in the minds of farmers, no doubt did act as a deterrent on those who may otherwise have developed the pig-raising side of their operations.

The percentage of pigs condemned for disease at the abattoirs now, however, is very light, approximately one per cent., pointing to the healthy condition of our pigs as an average, the principal disease being tuberculosis.

Whatever be the cause or causes of the fluctuations mentioned above, there is no doubt that farmers have practised an "in-and-out" policy in their pig-farming, endeavouring to come into the business at the top of the market, a policy which benefits only those who remain constantly in the business and can sell their weaner pigs at high prices. A moment's reflection on the price of weaner pigs during the last 18-20 months indicates how profitable these have been to breed, weaner pigs having fetched as high as 30s. per head.

It is believed that by developing the pig industry on sound and systematic lines, dairy farmers, and in particular those on recently developed farms such as under the Group Settlement Scheme, can convert much of the produce grown on the farm into a marketable product, namely bacon, where difficulty would be experienced in doing this should reliance be placed on the cow only which, as has been shown, increases at a low rate, and are difficult to procure.

It is not sufficient, however, to grow pigs and sell them. It is necessary to produce the article required by the trade. With this end in view, the Hon. Minister for Agriculture (Mr. H. Millington) recently called a conference, inviting members of the bacon trade to discuss this question and arrive at a uniform policy, so that farmers throughout the State may have a definite line on which to work.

The following were present at the conference:—Hon. Minister for Agriculture (Mr. H. Millington), Director of Agriculture (Mr. G. L. Sutton), Superintendent of Dairying (Mr. G. K. Baron-Hay), Mr. Gray, Manager Stock Department, Elder, Smith & Co., Ltd., M. T. Wilding, President, and Mr. W. G. Burges, Councillor, of Royal Agricultural Society, Messrs Reid and Robinson, representing Foggitt Jones Pty., Ltd. Messrs. Bantock and Watson were unable to attend.

Type of carcase.—It was unanimously decided that the type, conformation, and general quality of carcases which meet the requirements of bacon curers also meet those of the pork trade, and *vice versa*.

It is undesirable and there is no need to introduce complications into pig production by requiring farmers to produce two distinct types of pigs according to whether they wish to supply the pork or the bacon market. Insofar as any variations exist in carcases demanded by these two sections of the industry, such variations are those only of weight and not type, given proper methods of feeding. ***This decision is of outstanding importance, as it is often assumed that different breeds or crosses are required to produce animals best suited to the pork and bacon markets respectively.***

It was decided that carcases for the pork or bacon trade should conform to the following specification:—

DESCRIPTION OF STANDARD CARCASES FOR PORK OR BACON IN WEST. AUSTRALIA.

The carcase must be that of a properly fed castrated male or virgin female pig.

The middle portion from the first rib to the hip or aitch bone must be long. The fore end must be light, with a light head and neck, and the hams well developed. Ribs must be well sprung, that is to say, they must not slope rapidly from the back bone, but clearly indicate where the back leaves off and the side begins. The line of the back must be slightly arched from head to tail, and not dished or humped over the shoulder. The neck must be of medium length and devoid of crest. The shoulders must be smooth, slightly rounded from side to side over the top and very compact. The back fat should be even, without pronounced thickening over the shoulder, and it should taper slightly from the shoulder to the rump, and should not be greater than 1½ inches at the shoulder in the bacon pig.

The underline must be straight and thick throughout its whole length, entirely free from flabbiness or distention of the flank. Thick lines or streaks of fat should be absent from the visible portion of the lean, and indications of leanness must be visible between the ribs.

The shanks must be short, bone fine, and the fore hock and ham free from wrinkles. The flesh must be carried well around the bone, leaving no bareness inside the thigh and well down to the knee and hock joints.

The vertibrae must be of a flesh pink colour and flinty in texture. The proportion of lean to fat must be good. The fat should be white and firm to the touch; when pressed with the thumb, an indentation should be formed which remains visible for a few minutes after pressure has been removed.

The texture of the lean must be fine grained, and not rough or fibrous. There must be no excess of internal fat—the kidneys should have a thin covering of fat.

The rind must be thin, flesh coloured, perfectly smooth, pliable and free from deep-rooted bristles, and must be devoid of any skin pigmentation. There must be no indication of black bristles and no sign of seedy cut.

The following carcase weights were decided upon as being in most demand by the trade, and most profitable to the producer:—

	Carcase weight.	Live weight.
	lbs.	lbs.
For Porker	50-70	72-100
For Bacon—Grade 1 ..	100-115	143-164
Prime ..	116-130	165-186
Grade 2 ..	131-140	186-200

Farmers are not advised to market porkers of a less carcase weight than 50 lbs. or a greater weight than 70 lbs., although many such pigs are continually being forwarded to the sales. It is more profitable to "run" a pig over 70 lbs. to the bacon stage, as it is from this weight onwards that a pig shows the greatest daily gain. This weight is also an "out size" and not in demand by either the pork butcher or the bacon curer.

The following table gives the relative value per lb. of carcases at the weights shown, and demonstrates clearly the advisability of keeping within the grade weights as recommended above:—

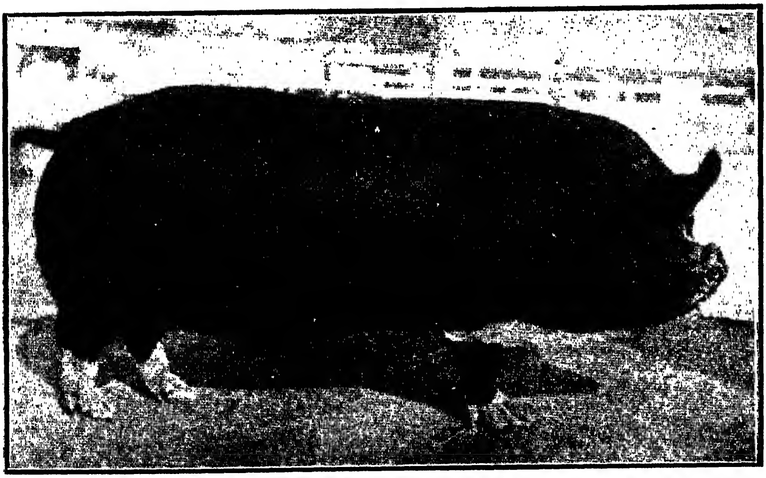
Carcase weight. lbs.	Value per lb.	Value per carcase at top weight. £ s. d.
50-70	10d.	2 18 4
100-115	8d.	3 16 8
116-130	8d.	4 6 8
131-140	7¾d.	4 10 5
141-150	7½d.	4 13 9
151-160	6d.	4 0 0
161-180	4½d.	3 7 6

A pig weighing 140 lbs. carcase weight fetches 3s. 9d. more than one of 130 lbs., and has to be kept at least 10 days longer.

A pig of 150 lbs. weight fetches 3s. 4d. more than one at 140, and 7s. 1d. more than one at 130 lbs., and has to be kept 10 days and three weeks longer respectively.

Carcases conforming to the description given above produce a high proportion of the best cuts whether as pork, or bacon, and are the product of selective breeding and proper feeding methods.

A Pure Bred Berkshire Boar.



The Pure Bred Berkshire Boar is recommended for "Grading-up" herds of any breed, and is particularly desirable for mating with Tamworth or Tamworth Grade Sows for the production of bacon.

The task of the farmer is to supply the carcase thus described, which involves two factors:—

(a) Breeding.

(b) Feeding, to be considered in a later issue of this Journal.

Breeding.—The question of breed was considered also by the conference mentioned above. It was unanimously agreed that, for West Australian

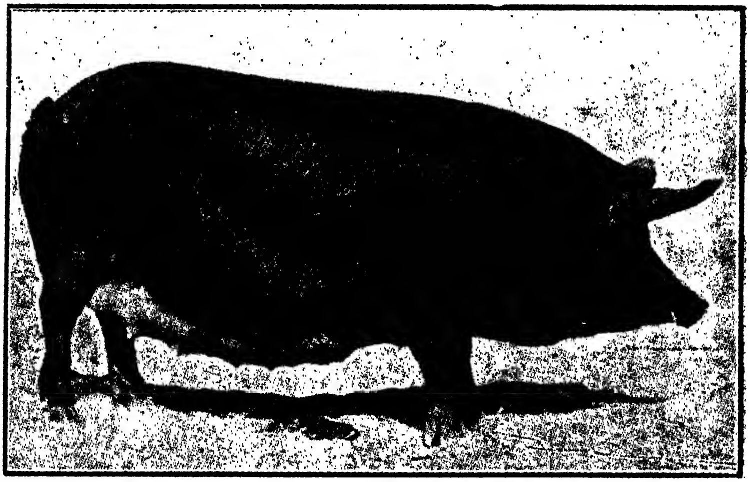
conditions, a combination of the Berkshire and Tamworth breeds yielded the best bacon pig, and also an excellent porker.

The ideal pig would be obtained by the production of the breeding sow from mating pure-bred Berkshires with pure-bred Tamworths, and mating the sows from this cross back to a pure-bred Berkshire boar. This is known as the "Berkshire-Tamworth Comeback."

Opinion differs as to whether a Berkshire sow should be mated with a Tamworth boar, or *vice versa,* to produce breeding sows for bacon purposes, excellent results having been obtained by each method. The writer prefers the Berkshire boar being mated with a Tamworth sow. This cross yields an early maturing pig. The sows are prolific, good mothers, and suited to conditions in this State, and in the opinion of bacon curers produce a carcase required by the trade.

In grade herds of various breeds, the pure-bred selected Berkshire boar is recommended for "grading up" and the production of bacon pigs.

A Pure Bred Tamworth Sow.



This type of sow, mated with Pure Bred Berkshire Boar, produces progeny suitable for both pork and bacon trades. Female progeny mated with an unrelated Pure Bred Berkshire Boar produce the ideal bacon pig.

It is also strongly recommended that, in using representatives of the above breeds, care should be taken to select animals of good type, particularly with the Berkshire boar being used to produce bacon pigs. This animal should show in his conformation as many of the desirable points as possible mentioned in the description of the carcase above, and must be pure bred, the only proof of which is registration in the Herd Book.

In order to produce standardisation within the pig industry, great importance is attached to the selection by the farmer of a suitable breed or cross, which principle is considered the foundation of the trade.

The above recommendation has been based on purely commercial considerations; and concentration on two breeds or crosses, which supply the demands of the market, is undoubtedly preferable to diversity.

SOME PARASITIC AND NON-PARASITIC CAUSES OF "EMPTY" OR "TIPPED" HEADS IN WHEAT.

H. A. PITTMAN, B.Sc.Agr.,
Plant Pathologist.

There are a number of different causes of the presence of "empty" or "white" heads in wheat crops at harvest time. In years with normal rainfall and normal climatic conditions the most serious are various kinds of root- and stem-attacking fungi, such as those causing the diseases known as "Take-all" (*Ophiobolus graminis*, Sacc.), "Root-rot" (*Wojnowicia graminis* (McAlp.) Sacc. & D.Sacc.), and "Foot-rot" (*Helminthosporium sativum*, Pammel, King and Bakke).* Frost during the flowering period, insufficient depth of soil, water-logging, water deficiency, insufficient mineral substances such as phosphoric acid, excessive wind action, and excess "salt," wood ashes, or "alkali" in the soil, may also cause the occurrence of more or less completely empty heads in wheat crops.

In very dry seasons like that just passed, "Take-all" and kindred diseases are usually at a minimum, and the chief cause of either "empty" or tipped" heads is a comparatively dry soil, combined with strong wind-action round about the time of development and flowering of the wheat heads in the spring.

WIND ACTION AS A CAUSE OF EMPTY AND TIPPED HEADS IN WHEAT.

Following abundant rains over almost the whole of the wheat belt in Western Australia during the winter months of the season 1929-30, the ensuing spring was unusually dry and characterised by more or less continuous, hot, drying winds. As a consequence, the much-hoped-for yield of 50,000,000 bushels did not eventuate, and at the present time the indications are that the total returns will be in the vicinity of little more than 38,000,000 bushels.† Early in November, after a spring unprecedented for dryness in many districts over a period of more than thirty years, the estimated yield stood at 35,000,000 bushels, but the unusual advent of

* The use of the terms "Root-rot" and "Foot-rot" in the restricted sense used throughout this article was suggested by W. M. Carne, formerly Economic Botanist and Plant Pathologist to this Department, in an article entitled "Root-rot and Foot-rot of Wheat" in the December issue of this Journal for 1927, page 483, as follows:—" . . . . . This article is intended to draw attention to two diseases somewhat resembling Take-all and often confused with it. One of these is due to *Helminthosporium sativum*, which causes the condition known as Foot-rot, and the other to *Wojnowicia graminis*, which also causes a foot-rot, but for which the term Root-rot is suggested. It must be understood at once that all three fungi cause a root or foot-rot disease, and the terms used are simply for convenient distinction." The article referred to has been freely used in the preparation of the latter part of this paper, and the suggestion re the restricted use of the terms "Root-rot" and "Foot-rot" adopted. —H.A.P.

† This is, nevertheless, a record harvest for the State, the highest previous yield having been 36,370,219 bushels from 2,998,523 acres in 1927-28. The highest previous acreage under wheat for grain was 3,343,530 acres in 1928-29, in which season 33,790,040 bushels were harvested.—H.A.P.

unexpectedly heavy downpours during that month revived many of the later-maturing varieties, and added several million bushels to the harvest. Owing to the special effort put forward by farmers on the occasion of the State's Centenary (1929), 3,509,010 acres were sown and the 50-million bushel yield was apparently not beyond the possibility of attainment, given a normally good season. That the failure to come within a reasonably close distance of the goal was due almost entirely to an unusually unfavourable spring and early summer, few will doubt. On the 17th October, 1929, when the writer was *en route* to the Experiment Farms at Merredin and Southern Cross, many of the crops in ear adjoining the railway line were little more than a foot in height from Spencer's Brook eastwards, instead of standing some 2½-3 feet high.

Much of the wheat was very obviously "tipped," i.e., the tips of the ears were whitened, under-developed and devoid of grain. (See Figs. 1 and 2.)

Fig. 1.—Wheat heads showing the effects of hot, drying winds, at, or about, the flowering period. The two outside heads are normal, all the others show a greater or less amount of injury by wind action. The two heads second from the right and left, respectively, are completely whitened and free from grain. (*Photo. by Author.*)

The whitish colour of the tips contrasted sharply with the rich green of the lower, grain-filled portions of the heads. Sometimes completely white heads were seen, and on examination these were always found to be quite empty. Not infrequently heads with the normal green colour showed a complete absence of grain on being opened. The damage, of all kinds, was often particularly marked in late-maturing varieties, such as "Yandilla King" and "Baroota Wonder Early," while early-maturing sorts, such as "Noongar," "Geeralying," or "Gluya's Early," usually did not suffer to anything like the same extent. At the Experiment Farms where early, mid-season and late varieties are grown for demonstration purposes, side by

side, the slightly affected early-maturing varieties frequently showed to great advantage alongside the more seriously affected mid-season or late kinds, especially in the "Date of Sowing" experiments where the mid-season and late-maturing varieties had been sown somewhat later than their ideal sowing dates.

The vast majority of the plants affected with "tipping" or "empty heads" were not affected with any such root and stem diseases as "Take-all," "Root-rot," and "Foot-rot," as a plant disease survey in the Field, and a study of specimens submitted to the writer at Head Office by anxious farmers for report, revealed that such diseases were at an absolute minimum, presumably owing chiefly to the hot, dry, conditions of the late winter and spring. Of the very numerous samples of wheat with "tipped" and "empty" heads sent in for diagnosis by farmers in such widely scattered areas as Trayning, South Kumminin, East Pithara, Walgoolan, Keane, Salmon Gums, Southern Cross, Koorda, Gutha, Bencubbin, Wongan Hills, Merredin, Winchester, Canna, Nukarni, Burracoppin, Tammin. Muckinbudin, Carani, Corrigin, Moulyinning and Bruce Rock, only two specimens were affected with "Take-all" (*Ophiobolus graminis*) and one with "Root-rot" (*Wojnowicia graminis*). All the other samples were extraordinarily clean and free from troubles at the root or base of the stem. As a matter of fact, taking the State as a whole, rarely have parasitic diseases of wheat been so little in evidence as during the past season.

While "tipping" was common on the heavy land (growing, say, "salmon gum" "morrell" and "gimlet") complete emptiness of the affected ears was the more usual manifestation of trouble on the lighter land or sand-plain (growing, say, stunted "mallee," stunted scrub, broombush, tamma and tussock rush), in spite of the frequently reiterated statement in the Press and elsewhere that in a bad season sand-plain usually gives the best returns. Plants growing on the sites of old anthills or along headlands frequently suffered severely. Crops on newly cleared, hastily prepared sand-plain were much more severely affected than where the land had been cleared for some years and had become more consolidated, and freer from air pockets caused by the ploughing-in of dead leaves, sticks, roots, branches and twigs in the clearing process. As an illustration of this, certain farmers in the Corrigin district obtaining 18 bushels per acre from their old sand-plain, obtained only 9 bushels per acre from the same variety grown under otherwise identical treatment on strictly comparable, newly-cleared land. In the same district in the 1928-9 season on newly-cleared once-fallowed sand-plain, a certain farmer obtained only 249 bags of "Nabawa" wheat from 200 acres. The wheat on the heavy land of the same farm was badly "tipped,' while on the sand-plain the ears were almost entirely empty. Some weeks prior to harvesting the sand-plain crop had been estimated by experienced farmers to yield 12-15 bushels per acre.

On "stripping" or "harvesting" during the present season (1929-30), many farmers on both sand-plain and heavy country were greatly surprised to find that the yields were very much below their estimates formed sometime prior to harvesting.

CAUSE OF THE TROUBLE.

The type of "tipping' or "empty" head condition in wheat herein referred to would appear to be very largely due to the action of hot, dry winds in blowing through the crop, at, or about, the flowering period, and

causing a greater loss of water by transpiration ("evaporation") from the leaves than the root system can make good in the same time. The leaves, to save themselves from death, as it were, then draw water back, or cause it to be diverted, from the developing ears, with the result that a greater or less number of developing husks and male and female parts are killed and grain-formation is prevented. Unfortunately there can, of course, be

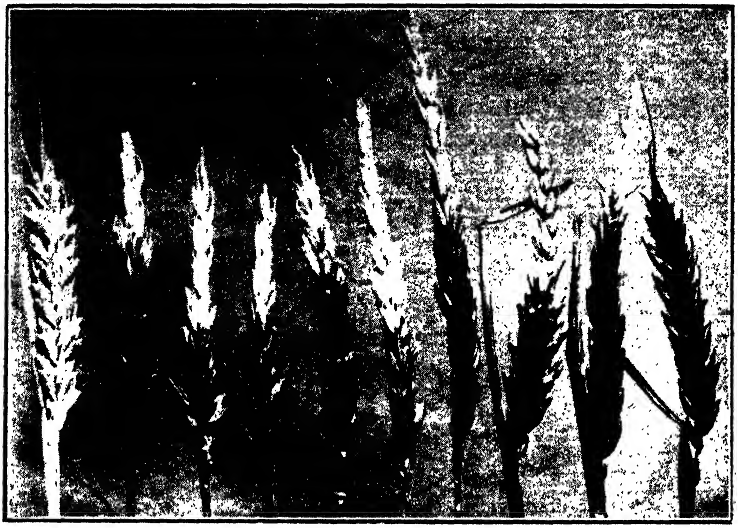


Fig. 2.—Wheat heads showing the effects of hot drying winds at, or about, the flowering period. The head on the extreme right is normal, that on the extreme left completely whitened and empty; all the others are "tipped," *i.e.*, whitened and free of grain for a greater or less portion of the terminal part of the head. (*Photo. by Author.*)

no replacement of parts in the heads, even though the weather conditions should become ideal from a plant-growth and -development point of view immediately thereafter. In some cases only a spikelet or two at the tip of the ear becomes affected, but in others the whole ear may be sucked dry by the almost parched leaves. Direct drying out of the delicate tissues by the hot winds no doubt often plays a part in the development of the condition. That it is, frequently, however, due more to the withdrawal (or withholding) of water from the ears by the leaves, than to direct drying out or scorching up of the delicate parts by the heat is rendered obvious by the fact that the writer has frequently opened up leaf-sheaths, which were themselves quite unaffected and bore normal leaf-blades, only to find that the as-yet-unexposed portions of the ears have been already more or less whitened and rendered sterile, while still protected in the leaf-sheaths from direct contact with external conditions. Often a whitened ear-tip would be

found just protruding from its encircling leaf-sheath. On opening up the sheath the injury was often apparent for many more spikelets down the ear. As a matter of fact, the writer formed the very strong impression from field observations that many of the heads had been irreparably damaged before any part of the ears ever protruded from the sheaths into contact with the external atmosphere. On the other hand it is not uncommon, especially on sand-plain, to find empty heads remaining green and normal-looking until close to the ripening period of the uninjured heads. In such cases direct killing of the male and female parts at flowering time by the hot, drying winds may be the most important causal factor.

CONTROL.

Apart from the recognised methods of good farming, it is difficult to see just what can be done to prevent the formation of "tipped" or "empty" heads in wheat crops under the influence of hot drying winds at or about flowering time, as the trouble is so closely linked up with adverse climatic conditions. From a study of the occurrence of the phenomenon in the field, and a close analysis of the numerous letters of farmers on the Departmental Files dealing with the trouble, several things clearly stand out. These have been mentioned above, but their reiteration will not be amiss here. They are:—

1. Complete emptiness of the ears is much more common on the light lands or sand-plains growing say, stunted "mallee," broom bush, tamma, stunted scrub, and tussock-rush than on the heavy "forest" country growing say, salmon gum, morrell and gimlet.

2. Newly-cleared, and especially hastily-prepared light-lands, are much more prone to the trouble than such soils after some years of cropping when the soil has become more consolidated. This is undoubtedly due to the fact that newly-cleared or hastily-prepared light-lands almost always contain large quantities of ploughed-in roots, branches and leaves. These lead to the formation of numerous air pockets in the soil. The looseness of the soil and the air pockets cause a reduced root development. When, then, a critical period occurs just prior to, or at, the time of flowering, the leaves are apt to lose more water to the winds in a given period than the root system can replace. The ears then have to suffer for the shortcomings of the roots. More damage occurs in a dry year than in a wet, because the surface soil in wet years contains much more moisture, and is more compacted. As the years go by and the roots, branches, etc., decay, and the soil becomes still more consolidated by the movement of the horses and machinery, better root development on the part of the wheat plants occurs and less trouble eventuates in the ears in critical periods.

3. Other things being equal, in very dry years varieties flowering early suffer less than those flowering later in the season.

From what has been said above, it is obvious that the following measures will all tend to reduce losses from wind action during or around the flowering period in seasons of below-average rainfall:—

1. Careful preparation and consolidation of light-lands by conscientious clearing, a good burn and frequent shallow cultivations with heavy implements before sowing to establish a firm seed-bed.

2. The growth of the earliest possible varieties suitable for the district.

3. The use of abundance of superphosphate so as to stimulate the development of the greatest possible rooting system, and lead to slightly earlier flowering.

4. Early and clean fallowing should be practised (quite apart from all other considerations such as the control of diseases like "Take-all," "Flag-smut," etc.) to conserve the greatest possible amount of moisture for the growth of the ensuing crop.

5. The seed of the varieties selected should be sown in the right amounts and at the right time. The correct dates for sowing and amounts of seed per acre for any variety in a given district can be ascertained by enquiry from the Superintendent of Wheat Farms at Head Office, or from the Manager of the nearest Experimental Farm. Boiling the situation down to its essentials the following points for control come out:—Good preparation of the seed bed, early fallowing, clean fallowing, the growth of early-maturing varieties, seasonable sowing, and abundant fertilizing with superphosphate. As stated above, however, these are simply the accepted modern precepts of good farming, so that the farmer who carries them out conscientiously can rest assured that he has done all that is humanly possible to prevent losses by wind action round about the period of development and flowering of the wheat heads.

CONFUSION OF WIND INJURY WITH FROST INJURY.

The occurrence of frost during the flowering of the crop is apt to cause a killing of the male and female parts and husks in various parts of the heads, with the result that the ears will be more or less empty of grain at harvest time. As all the flowers in a wheat ear do not normally mature at the same time, the effect of frost is usually to kill some flowers and husks without affecting others. With frost injury, therefore, some ears will usually be free of grain and have injured husks at the top, others at the base, and still others in the middle. Wind action, on the other hand, either kills *all* the flowers in a head, or affects a greater or less number *from the top down.* Frost injury is most common in low-lying situations, whereas wind injury in undulating country is most frequent on the tops or slopes of hills and not in the depressions. In practice there is usually little difficulty in distinguishing frost injury from wind injury, as, apart from anything else, a knowledge of the local climatic conditions during the critical period in the development of the ears generally provides a ready clue to the cause of the trouble.

CONFUSION OF WIND INJURY WITH "EMPTY" OR "WHITE" HEADS CAUSED BY PARASITIC DISEASES SUCH AS "TAKE-ALL," "ROOT ROT" OR "FOOT ROT."

Whereas plants whose ears have been injured by wind action are usually quite free from any discolouration or rotting at the base of the stem and roots, injury by "Take-all," "Root-rot" or "Foot-rot" can be readily diagnosed by the presence of more or less root-rotting and considerable black discolouration or brown staining at the base of the plants.

(See Fig. 3.) While these parasitic diseases are chiefly found in normal or over-wet seasons, wind injury, as shown above, is largely confined to the seasons of below-average rainfall. The chief distinguishing features and the control measures for "Take-all," "Root-rot" and "Foot-rot" are given below.

Fig. 3.—Showing root-rotting and blackening of the bases of stems and leaves of wheat plants attacked by "Take-all." (*Photo. by Author.*)

"Take-all" (Cause = *Ophiobolus graminis*).—Attacks usually in more or less rounded patches, or strips, of varying size. May kill seedlings or half-grown plants, or cause "whiteheads," that is, prematurely ripe heads without grain. The stem-bases show a black discolouration extending above the ground level and covering a length of stem of up to about two inches. The discolouration is partially superficial, and a black felt of fungal-growth can be scraped off the stem or the inner surfaces of the leaf bases surrounding it. Eventually the black fungal web which covers the base of the stem and lines the insides of the leaf-bases becomes thickly dotted with small rounded black bodies with short necks, which are the fruiting cases of the fungus.

Each case (*perithecium*) contains within it large numbers of fungus seed-structures (*spores*), grouped in bundles of eight in thin sheaths called *asci*. (See Fig. 4.) When mature, and the *perithecia* are moistened, the *asci* with their contained spores are forced out into the open. The *asci* then burst and set the spores in the bundles free. On germination the spores may attack any wheat, barley, rye, barley grass or other susceptible plants in the neighbourhood, and so continue the disease. In the absence of any suitable host, however, they soon die. So far as is known all our wheat varieties are equally subject to "Take-all," but specific information on the point is unavailable. Affected plants usually show considerable root-killing, and an unusually abundant development of woolly root hairs close to the stems. Grain is rarely produced by affected plants and, if so, is small and shrivelled.

"Take-all" may be found on all types of soil and in new or old, fallowed or non-fallowed land. It is most prevalent in warm, moist springs on old land sown down to wheat year after year. It is especially common with us in

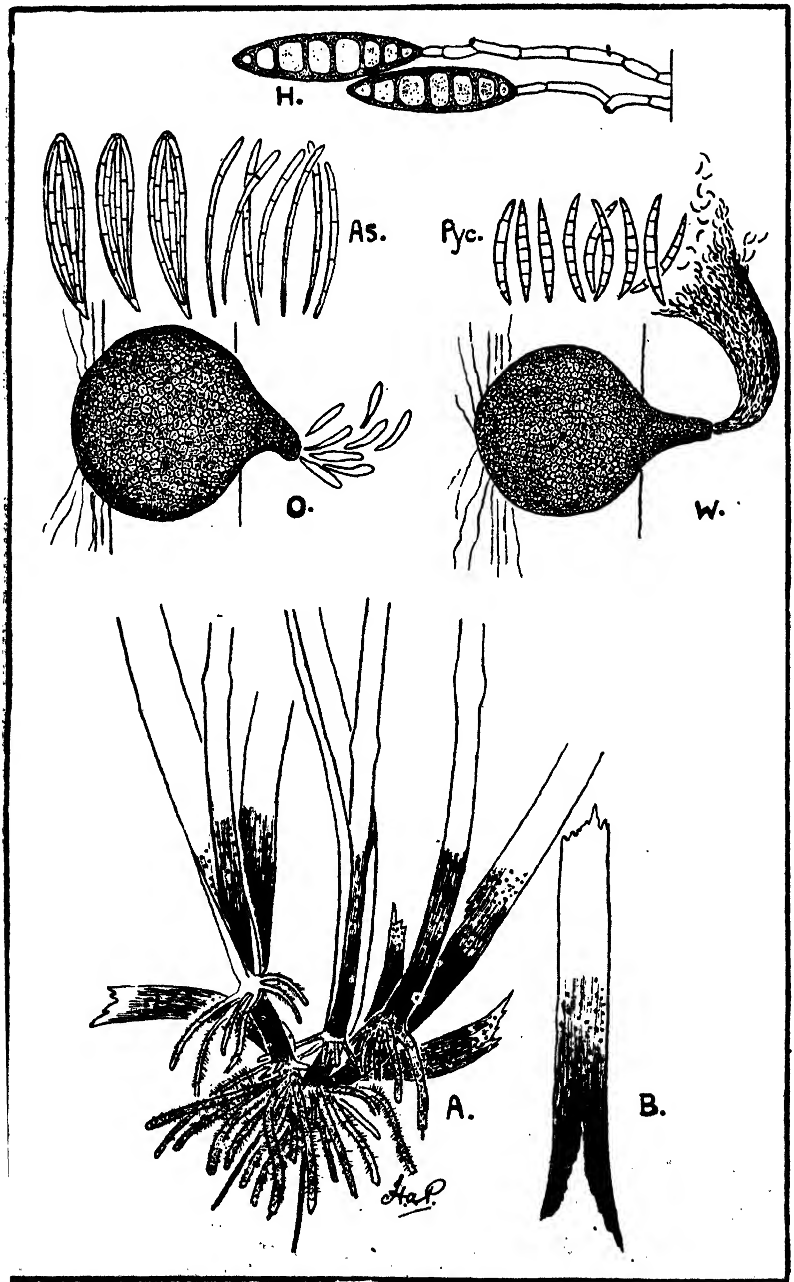


Fig. 4.—A. Wheat plant showing blackening at base of stems and inside the leaf-bases due to the "Take-all" fungus *Ophiobolus graminis*. B. Inner surface of leaf-base showing blackening and the fruiting bodies of *Ophiobolus graminis*. O. Fruiting case (*perithecium*) of *Ophiobolus graminis*, with escaping *asci*. W. Fruiting case (*pycnidium*) [illegible]

wet, poorly-drained places, and after a field has been allowed to grow up into grass. It is rare and need never be feared on intelligently farmed, well-drained properties, where early and clean fallowing, "wet sowing," abundant fertilizing, shallow planting, and crop rotation are practised as routine matters of farm management.

"Root-rot" (Cause = *Wojnowicia graminis*).—Though this parasite may attack wheat in patches, the patches are more irregular than in "Take-all," sometimes appearing as strips. In more typical cases affected plants are scattered through the crop, and this also occurs even when some of the affected plants are in patches. Both "Root-rot" and "Take-all" may occur together, which makes field identification more difficult. Though plants may be killed as seedlings or before heading, "Root-rot" is usually not noticed until "whiteheads" begin to show up in a crop If grain is formed, it is usually shrivelled. The stem discolouration is less marked than in the case of "Take-all," and varies from dark brown to black in colour. It is partially superficial, so that it may easily be mistaken for "Take-all." The discolouration is, however, usually in spots and streaks rather than generally distributed over the surface as in the latter disease.

So far "Root-rot" has only been found in Western Australia on wheat. It appears to be about as equally common as "Take-all" and both are not infrequently found on the same plants. It appears to be favoured by the same temperature and moisture conditions which favour "Take-all." The spores are produced in globular bodies much resembling those found in the case of *Ophiobolus*, but they differ in that they may be somewhat hairy, instead of smooth, and do not have the spores produced in bundles. (See Fig. 4.) The spores themselves also differ, as can be seen from the drawings.

"Foot-rot" (Cause = *Helminthosporium sativum*).—This disease is similar to "Root-rot" in its field occurrence and usually is first noticed when "whiteheads" appear in the crop. The stem discolouration takes the form of dark brown streaks, spots or patches. There is no superficial black fungal growth, and the affected parts of the stems do not usually extend above ground.

Plants may be killed out in all stages of development and the occurrence of "whiteheads" is a common symptom (Fig. 5). The fungus is fortunately only rarely found in Western Australia. It has a very wide host range and various strains may attack wheat, barley, rye, and many different grasses, including barley grass (*Hordeum murinum*) and various species of brome grasses (*Bromus spp.*). Oats have not so far been found affected in W.A., although some varieties are slightly affected in other parts of the world. In this State the disease has so far only been found on wheat. Susceptible species may be attacked on the roots, stems, leaves, ears, and grains. The disease is most serious under rather high soil temperatures, and in the presence of abundant moisture.

CONTROL OF "TAKE-ALL," "ROOT-ROT" AND "FOOT-ROT."

The control measures for the three diseases are sufficiently similar to be considered identical from a practical point of view. Where conscientiously carried out little loss need be feared from any of the three over a series of years, although once they have become established on a farm there

may be an appreciable loss in seasons very favourable for infection. The control measures are:—

1. *A good, clean, stubble-burn in badly-affected patches or paddocks.* Where only small patches occur, straw from the neighbouring healthy areas should, if possible, be distributed over the diseased areas before firing, so as to make a more intense burn over the badly affected patches. Where the disease is serious there is, of course, only a limited amount of stubble

Fig. 5.—Showing wheat plants that have died of "Foot-rot," due to *Helminthosporium sativum*, in various stages of development.

(Photo. Department of Agriculture, N.S.W.)

formed, so that the necessity for some additional material for burning is obvious. The object of a stubble-burn is to destroy as much as possible of the diseased roots and the lower parts of the infected stems and leaves. These are the parts which carry the fungi. The latter do not die with the

plants but live in *spore* (seed-like) form in the dead wheat tissues. If not burnt, the infected parts of the stubble will be blown about the paddock and into other paddocks, especially if broken up by the trampling of sheep and horses. The headlands should also be burnt to destroy self-sown wheat or barley plants, barley grass, brome grasses, silver grass (*Festuca bromoides*), etc., which may be harbouring "Take-all" or "Foot-rot."

2. *Early fallowing.* Unfortunately, a stubble-burn does not destroy all the affected stem-bases, leaf-bases or roots, so that a burn is not sufficient in itself to effectively control these diseases. It is therefore necessary to follow up the stubble-burn by early ploughing in the late autumn or early winter, if possible, so as to turn the spores under into the moist soil. This does not cause them to rot, as might be supposed, but induces many to germinate. If the first ploughing is left till the spring the soil may be too dry to induce copious germination, and many of the spores may not germinate till the following winter, thus putting back the control of the diseases for another year. Once the spores have germinated they must find something to attack or die of starvation. This brings us to the third point in the control measures, viz.:—

3. *Clean fallowing.* If ploughed in the early winter or late autumn, or even if left unploughed till the spring, the winter rains will have induced a more or less plentiful growth of self-sown wheat, barley grass, brome grasses, silver grass and perhaps barley. These plants may be attacked by the spores already ploughed in, and in such a case, unless the plants are killed out by clean cultivation, the fungi will eventually form a new crop of spores. *Therefore the fallows should be kept free from all growth in the spring.* From July to November, in a cool, moist spring, or to October in more normal years, it is dangerous, from a disease point of view, for grasses to grow on infected fallows. After that the very high temperatures of the summer will usually prevent both the susceptible plants and the fungi developing.

4. *Rotation of crops.* In addition to the above measures, rotation with oats, peas, rape, lupins, clovers or any other suitable plants not belonging to the Grass Family will give another season for the spores in the soil to germinate and die. Oats are not affected by "Root-rot" or "Foot-rot" in Western Australia, and are to all intents and purposes immune from "Take-all." None of the other plants mentioned above are subject to any of the three diseases. After the rotation crop the paddocks should preferably be clean-fallowed before again coming back into wheat.

5. *"Wet-Sowing,"* i.e., sowing wheat after the commencement of the autumn rains, not before, when the season allows, gives any fungus spores that may still remain in the soil a further chance to germinate and die before the wheat is sown or germinates.

6. Abundance of superphosphate should be used and the seed should be sown about 1½ inches deep, if practicable, on a well-prepared firmly-compacted seed bed. It has been shown by Kirby in America (Cornell Uni. Agr. Expt. Sta. Memoir. 88, 1925) that although "Take-all" can be grown in artificial media with a wide range of acidity or alkalinity it prefers somewhat alkaline conditions. Superphosphate, having a somewhat acid reaction, tends to suppress the development of the "Take-all" fungus and in addition stimulates abundant root-development and increased resistance to disease on the part of the plants. The sowing of wheat on a properly consolidated seed bed also stimulates vigorous root development, and by giving the plants a good start in life tends to render them more resistant to the inroads of the fungous diseases herein discussed. The seed should

be sown about 1½ inches deep, as if planted deeper considerable time and energy is wasted by the young wheat seedlings in developing their permanent root system at the 1½-inch level. The occurrence of a long seedling stem segment between the seed and the point of development of the permanent root system at about the 1½-inch level, seems to favour attack on the plants by the various root- and stem-attacking fungi. Numerous specimens received at Head Office appear to have been first infected on the dead seedling stem segment between the seed and the 1½-inch level.

7. If cutting infected crops for hay, set the reaper and binder to cut not closer to the ground than three inches, so that diseased tissues will not be spread about the farm on the hay, chaff or in the droppings of animals.

When all the above practices have been carried out to the best of the farmer's ability, he must not forget that infected barley grass, brome grasses, silver grass, and various other grasses along the headlands, and in adjoining paddocks left in grass, are potential sources of infection to clean paddocks. *To let an infected area go to grass does not check the disease on that area. Rather it is liable to infect adjoining areas through infected fragments of the grasses being blown about by wind, or carried to them on the implements or by stock, etc.* (See Fig. 6.)

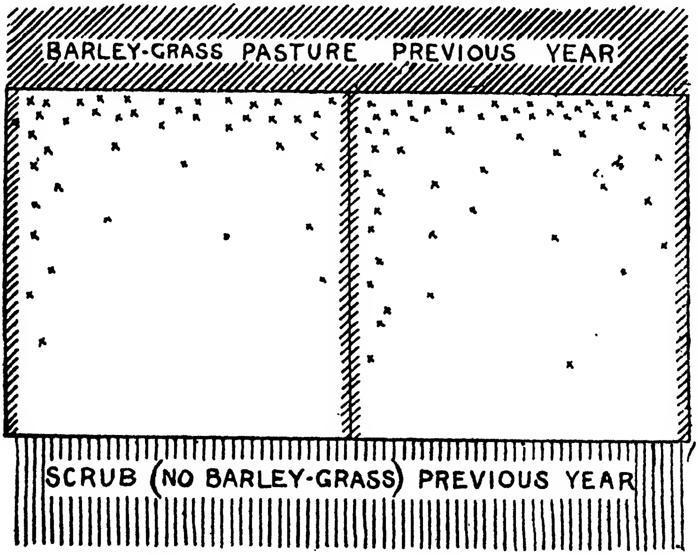


Fig. 6.—Diagram illustrating the manner in which two fields were affected with "Take-all." The crosses indicate the distribution of "Take-all" patches, but are not accurate plottings. (*After G. Samuel, "Take-all Investigations. 2." Journ. Dept. Agric. S. Aus., July,* 1924, *pp.* 1134-1147.)

If all the above recommendations are carried out conscientiously—and many of them are simply practices which should be carried out in the ordinary routine of good modern farming, quite apart from all considerations of disease—"Take-all," "Root-rot" and "Foot-rot" will be very greatly reduced in amount if not entirely eliminated from the wheat fields.

FIELD EXPERIMENTS WITH WHEAT, 1929.

YILGARN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms,
and
G. K. STEVENS, Farm Manager.

The monthly rainfall as recorded at the farm for 1929 and 1928, together with the average for the past 40 years as officially recorded at Southern Cross, eight miles west of the farm, are set out below:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.						Total.	Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.				
1929 ...	36	120	50	...	275	145	57	25	9	60	571	294	...	1,071
1928 ...	92	...	62	50	170	76	165	89	48	7	555	...	57	816
Average 40 years	50	59	106	72	194	139	144	107	79	63	726	50	46	1,057

Of the 571 points which fell during the growing period, May to October, 48 points fell on the day on which harvesting of the grain crop commenced, and therefore this was not beneficial to the crops. Of the other precipitations which were recorded during the growing period, 420 points fell during the months of May and June, the balance of 103 points being spread over the four months July, August, September and October as compared with the average of 393 points for the same period. During the critical months of August and September 34 points only were recorded. The average for this period is 186 points. The previous year (1928) the rainfall for these two months was 137 points.

From these records it will be seen that with the exception of the excellent rains which were experienced during the months of May and June, resulting in even germination, the crops were grown under extremely adverse climatic conditions.

The land on which the experiments were carried out was cleared of salmon gum and gimlet timber in 1928/29, and except where otherwise stated was ploughed in July, 1929, with a disc implement and cultivated with a springtyne cultivator in September, twice after rain during the summer and again prior to seeding.

Time of Seeding Experiment.

The object of this experiment is to determine the most suitable month to plant the wheat crop.

Two varieties of different maturity were used—Nabawa, a midseason; and Gluyas Early, an early maturing variety.

The Nabawa plots were planted mid-April, May and June, and the Gluyas Early were planted mid-May, June and July.

The April sown plots did not germinate until after rain on the 1st of May. The other plots germinated immediately after planting.

The April and May plots of the midseason variety and the May plots of the early variety stooled well and made strong growth during the early part of the season.

The other plots, although good germination was obtained, made poor growth, particularly the Nabawa plots planted in June and Gluyas Early plots planted in July, the latter being very spindly, some plants not stooling at all.

YILGARN EXPERIMENT FARM.

TIME OF SEEDING EXPERIMENT, 1929.

Variety—Nabawa. Superphosphate (22%) 112lbs. per acre. Seed—42lbs. per acre.

Time of Seeding.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average yields per acre 1929.	Percentage yields, 1929.	Average yields per acre 1928-29.	Percentage yields 1928–29.
	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	%	bs. lbs.	%
April	12 25	11 5	12 55	11 56	13 24	12 21	123	16 41	105
May (Control) ...	9 59	9 38	10 43	9 30	10 29	10 4	100	15 50	100
June	4 52	5 28	6 5	5 14	5 28	5 25	54	8 32	54

YILGARN EXPERIMENT FARM.

TIME OF SEEDING EXPERIMENT, 1929.

Variety—Gluyas Early. Superphosphate (22%) 112lbs. per acre. Seed—42lbs. per acre.

Time of Seeding.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average yields per acre 1929.	Percentage yields, 1929.	Average yields per acre 1928-29.	Percentage yields 1928–29.
	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	%	bs. lbs.	%
June	4 52	5 6	5 50	5 36	6 5	5 30	59	9 30	63
May (Control) ...	10 14	7 48	9 8	7 48	11 34	9 18	100	14 59	100
July	1 42	2 26	2 33	2 12	1 20	2 3	22	4 15	28

Although these results are for one year only, they show the advisability of completing the planting of the wheat crop during the month of May, and they also indicate that there is an advantage in commencing to plant a midseason variety in April.

Rate of Seeding Experiment.

The object of this experiment is to determine the most economic rate of seeding with (a) a midseason free stooling, and (b) an early and sparse stooling variety.

For the former the variety Nabawa, and for the latter the variety S.H.J. were used.

The germination on all plots was good. The lighter seeded plots appeared to have stooled better. Otherwise the general appearance of the plots was very even.

YILGARN EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT, 1929.

Variety—Nabawa. Planted on 27th April. Superphosphate (22%) 112lbs. per acre.

Rate of Seeding.	Computed Yields per Acre.					Average yields per acre 1929.	Percentage yields, 1929.	Average yields per acre 1928-29.	Percentage yields 1928–29.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	%	bs. lbs.	%
23lbs. per acre ...	12 55	11 56	12 33	11 20	11 12	11 59	97	16 34	101
45lbs. per acre (Control)	12 11	13 2	12 25	11 34	12 25	12 19	100	16 26	100
33lbs. per acre...	11 56	13 24	10 14	10 7	11 29	11 26	93	15 50	96

YILGARN EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT, 1929.

Variety—S.H.J. Planted on 21st May. Superphosphate (22%)—112lbs. per acre.

Rate of Seeding.	Computed Yields per Acre.					Average yields per acre 1929.	Percentage yields, 1929.	Average yields per acre 1928-29.	Percentage yields 1928–29.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	%	bs. lbs.	%
23lbs. per acre ...	7 41	6 49	6 56	6 27	6 41	6 55	109	10 43	105
45lbs. per acre (Control)	6 12	6 56	6 19	5 43	6 34	6 21	100	10 14	100
33lbs. per acre...	6 12	6 49	6 41	6 49	7 11	6 44	106	10 36	104

These results being for two years only, no definite conclusion can be drawn. However they appear to indicate that there is no advantage to be gained by heavy rates of seeding.

Time of Application of Superphosphate Experiment.

The object of this experiment is to determine whether, when heavy dressings of superphosphate are applied, it would be profitable to apply part or whole of the amount when cultivating the fallowed land during the late summer and early autumn.

For the purpose of the experiment, three plots were required.

Plot 1 received 75 lbs. in March and 150 lbs. at seeding.

Plot 2 was treated as control and received the whole 225 lbs. in March.

Plot 3 received 150 lbs. in March and 75 lbs. at seeding.

YILGARN EXPERIMENT FARM.

TIME OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT, 1929.

Variety—Gluyas Early. Planted 9th May. Seed—42lbs. per acre.

Time of Application of Superphosphate.	Computed Yields per acre.										Average yields per acre 1929.		Percentage yields 1929.	Average yields per acre 1928-29.		Percentage yields 1928-29.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
75lbs. in March, 150lbs. at seeding	8	17	6	41	6	41	6	27	5	14	6	40	137	15	36	113
225lbs. in March	4	1	5	36	4	30	5	14	4	59	4	52	100	13	46	100
150lbs. in March, 75lbs. at seeding	5	58	7	19	4	37	4	23	8	17	6	7	125	14	51	108

The results confirm those of last year and indicate that the yields are decreased when portion of the fertiliser is not applied at seeding time.

Rate of Application of Superphosphate Experiment.

The object of this experiment is to determine the most economical rate to apply superphosphate to the wheat crop.

The experiment was commenced at this farm the previous year when three plots were used, and the rates of fertiliser compared were 75 lbs., 150 lbs., and 225 lbs. per acre.

This year the number of plots was increased so as to include plots receiving no fertiliser and 300 lbs. respectively. In order to maintain the three-plot system the experiment was divided into two sections.

In the first section plot No. 1 received no fertiliser; No. 2, 150 lbs.; and No. 3, 75 lbs.

In section two, plot No. 1 received 225 lbs.; No. 2, 150 lbs.; and No. 3, 300 lbs. In both sections the plot receiving 150 lbs. of superphosphate was treated as the control plot.

All plots made vigorous growth during the early part of the season, but were seriously affected during the latter part of the season. The plots receiving the heavier applications matured more rapidly.

YILGARN EXPERIMENT FARM.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT, NO. 1, 1929.

Variety—Gluyas Early. Planted 9th May. Seed—42lbs. per acre.

Rate of Application of Superphosphate.	Computed Yields per Acre.										Average Yields per acre 1929.		Percentage Yields 1929.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
300lbs. per acre ...	4	23	5	43	4	45	3	39	5	43	4	51	65
150lbs. per acre (Control)	6	41	7	19	7	26	6	19	9	30	7	27	100
225lbs. per acre ...	6	12	5	28	4	37	5	50	7	48	5	59	80

YILGARN EXPERIMENT FARM.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT, NO. 2, 1929.

Variety—Gluyas Early. Planted on 9th May. Seed—42lbs. per acre.

Rate of Application of Superphosphate.	Computed Yields per Acre.					Average Yields per acre 1929.	Percentage Yields 1929.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
No superphosphate	7 33	7 41	5 36	6 5	5 28	6 29	58
150lbs. per acre (Control)	11 56	12 4	10 7	11 5	10 58	11 14	100
75lbs. per acre ...	10 51	10 58	9 59	9 52	10 7	10 25	93

The results are for one year only and no definite conclusions can be arrived at. They indicate, however, that the yields are increased when rates of superphosphate in excess of 75 lbs. and up to 150 lbs. per acre are used.

Nitrogen Experiment.

The objects of this experiment are:—

1. To determine whether increased yields are obtained when heavy dressings of sulphate of ammonia are applied to the wheat crop in addition to an application of superphosphate.

2. To ascertain whether it is advantageous to apply only part of this nitrogenous fertiliser at seeding time and part during the month of August.

For the purposes of the experiment two rates of sulphate of ammonia were applied, viz., 1 cwt. and 2 cwts. respectively.

Superphosphate was applied to all plots at the rate of 120 lbs. per acre, and those plots to which superphosphate only was applied were treated as controls. Comparisons were made between these control plots and those plots receiving 1 cwt. and 2 cwts. of sulphate of ammonia respectively. With each of these dressings the whole of the fertiliser was applied at the one time, viz., at seeding, in the one instance and also, in separate plots, the application of half of the sulphate was delayed until the month of August.

That portion of the experiment dealing with the application of 1 cwt. of sulphate of ammonia was repeated three times, while that portion dealing with the 2 cwts. of sulphate per acre was duplicated.

This experiment was conducted on fallowed land, and throughout the growing period there was no apparent difference between the growths of the various plots.

The results obtained are tabulated hereunder:—

YILGARN EXPERIMENT FARM.

NITROGEN EXPERIMENT, 1929.

FALLOW.

Variety—Gluyas Early. Planted on 15th May. Seed 42lbs. Superphosphate (22%)—120lbs. per acre.

Treatment.	Computed Yields per Acre.					Average yields per acre 1929.	Average percentage yield, 1929.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.		
	b's. lbs.	b's. lbs.	b's. lbs.	b's. lbs.	b's. lbs.	bus. lbs.	
½ cwt. Ammonium Sulphate at seeding; ½ cwt. Ammonium Sulphate in August	7 3	...	6 49	...	4 59	6 17	79
No Ammonium Sulphate (Control)	8 17	...	7 26	...	8 10	7 57	100
1 cwt. Ammonium Sulphate at seeding	8 25	...	7 19	...	8 54	8 13	104
1 cwt. Ammonium Sulphate at seeding; 1 cwt. Ammonium Sulphate in August	...	7 11	...	6 40	...	7 0	93
No Ammonium Sulphate (Control)	...	9 1	...	6 5	...	7 33	100
2 cwt. Ammonium Sulphate at seeding	...	8 39	...	6 41	...	7 40	102

These results are for one year only and therefore no definite conclusions can be derived. The figures, however, indicate a sight increase in yield when a nitrogenous fertiliser is applied at seeding time. They also indicate that there is a decrease in yield when part of the nitrogenous fertiliser is applied during the spring. It is possible that this decrease is due to the burning or parching effect on the crop.

Seasonal Planting Experiment.

The objects of the experiment are—

(1) To ascertain the most suitable month to plant the Late, Midseason, Early and Very Early maturing varieties of wheat.

(2) To determine the most prolific of each of the above types.

To meet the requirements of this experiment three sections were needed, viz.:—

(a) Section 1, planted in April, representing Early planting.

(b) Section 2, planted in May, representing Midseason planting.

(c) Section 3, planted in June, representing Late planting.

Each section planted in its respective month was repeated five times, all plots being eventually harvested for grain.

The standard Midseason variety Nabawa was planted in the control plots in all sections.

April Planting.—The seed was planted in a dry seed bed and consequently it did not germinate until rain fell on the 1st of May. Germination was good and during the early part of the season all varieties made good growth, but were all affected by the adverse climatic conditions which prevailed during the latter part of the season. The varieties Baroota Wonder Early and Merredin were the first to show signs of distress. The very early variety Noongaar was the least affected. This variety came into ear in July and, as a useful rain was experienced immediately prior to this, it matured under more normal conditions than did other varieties.

YILGARN EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT, 1929.

APRIL PLANTING.

Planted—15th April. Seed—42lbs. per acre. Superphosphate (22%)—112lbs. per acre.

Variety.	Maturity.	Computed Yield per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yield, 1929.	Average Percentage Yield, 1929.	Average Percentage Yield, 1928-29.
		bs lb.	bs. lbs.	bs. lbs.	bs. lb.	bs. lb.	bs. lb.	%	%
Baroota Wonder, Early	Midseason ...	7 41	5 14	5 36	5 21	5 6	5 48	42	...
Nabawa (Control)	Midseason ...	15 50	12 4	13 24	12 47	14 30	13 43	100	100
Canberra	Early ...	10 36	9 8	7 48	11 5	11 27	10 1	73	90
Gluyas Early ...	Early ...	14 0	12 25	11 5	13 2	17 3	13 31	104	97
Nabawa (Control)	Midseason ...	14 22	12 11	10 58	11 49	15 50	13 2	100	100
Merredin	Early ...	9 38	9 52	5 58	8 17	11 12	8 59	69	85
Carrabin	Early ...	13 24	13 24	9 38	11 12	14 0	12 20	99	...
Nabawa (Control)	Midseason ...	13 46	14 37	10 51	8 25	14 44	12 29	100	100
Noongaar	Very Early...	17 54	18 16	17 10	13 53	18 1	17 3	137	104

When perusing these results, it must not be overlooked that although the seed was planted on 15th April, it did not germinate until the first week in May.

In view of the scanty rainfall after the month of June, the results this year, as would be expected, are in favour of the very early maturing variety Noongaar.

In the light of past experience, however, in normal seasons it would be unwise to plant a very early maturing variety early in May owing to its liability to the disease Septoria. The varieties Baroota Wonder Early, Merredin and Canberra have not shown to advantage.

May Planting.—The seed was planted on an ideal seed bed and consequently the germination was excellent.

YILGARN EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT, 1929.

MAY PLANTING.

Planted—15th May. Seed—42lbs. per acre. Superphosphate (22%)—112lbs. per acre.

Variety.	Maturity.	Computed Yield per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yield, 1929.	Average Percentage Yield, 1929.	Average Percentage Yield, 1928-29.
		bs. lb.	bs. lb.	bs. lb.	bs. lb.	bs. lb.	bs. lb.	%	%
Baroota Wonder, Early	Midseason ...	3 10	3 24	2 33	3 46	2 12	3 1	34	...
Nabawa (Control)	Midseason ...	9 8	9 16	9 38	10 7	7 3	9 2	100	100
Canberra	Early ...	8 39	9 8	8 54	9 23	7 41	8 45	97	101
Gluyas Early ...	Early ...	13 2	11 34	10 58	11 34	9 45	11 23	118	109
Nabawa (Control)	Midseason ...	10 58	11 5	9 8	9 38	7 11	9 36	100	100
Merredin	Early ...	5 28	6 27	6 49	5 14	4 37	5 48	60	88
Carrabin	Early ...	7 48	10 7	9 52	8 25	5 58	8 26	93	97
Nabawa (Control)	Midseason ...	10 14	10 36	9 38	9 8	5 50	9 5	100	100
Geeralying ...	Very Early	11 20	10 58	10 14	9 23	6 19	9 37	106	105
S.H.J.	Early ...	9 38	8 39	8 32	9 8	7 26	8 41	87	88
Nabawa (Control)	Midseason ...	11 20	10 14	10 14	9 30	8 25	9 57	100	100
Noongaar	Very Early	15 7	13 58	14 37	13 9	12 25	13 50	139	116

These results are decidedly in favour of the standard early and very early maturing varieties, Gluyas Early and Noongaar. The variety Geeralying has also shown to advantage, whilst the varieties Baroota Wonder Early and Merredin, as was the case in the April planting, again showed at a disadvantage.

June Planting.—The germination on this section was irregular owing to the soil being of a heavy nature and inclined to set, and difficulty was experienced in maintaining the desired mulch. This affected all plots and in consequence all varieties were irregular in growth.

YILGARN EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT, 1929.

JUNE PLANTING.

Planted—15th June. Seed—42lbs. per acre. Superphosphate (22%)—112lbs. per acre.

Variety.	Maturity.	Computed Yield per Acre.					Average Yield, 1929.	Average Percentage Yield, 1929.	Average Percentage Yield, 1928-29.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bs lb.	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	bs. lbs.	%	%
Baroota Wonder, Early	Midseason ...	2 19	1 35	1 20	1 57	†	1 48	40	...
Nabawa (Control)	Midseason ...	5 58	4 15	4 1	3 53	†	4 29	100	100
Canberra	Early ...	4 23	2 55	2 4	2 55	†	3 4	68	112
Gluyas Early ...	Early ...	5 14	4 30	3 24	4 15	†	4 20	89	116
Nabawa (Control)	Midseason ...	5 43	4 59	3 32	5 14	†	4 52	100	100
Merredin	Early ...	4 30	3 46	2 26	3 24	†	3 32	73	98
Geeralying ...	Very Early	3 53	2 55	2 55	3 46	†	3 22	69	104
Nabawa (Control)	Midseason ...	5 14	4 30	4 15	5 28	†	4 52	100	100
S.H.J.	Early ...	2 48	2 19	2 19	2 33	†	2 27	50	81
Noongaar	Very Early	4 15	2 55	3 24	2 48	†	3 21	77	144
Nabawa (Control)	Midseason ...	4 52	4 1	4 23	4 1	†	4 19	100	100

† Plots too uneven to be used for purposes of comparison.

The yields obtained from this section are considerably below those obtained from the earlier plantings. The results are for two years only but they indicate very forcibly the necessity for completing the seeding of the wheat crop in this district by the end of May.

The outstanding feature of this section is the fact that the standard mid-season variety, Nabawa, has shown to advantage. This is not what may have been expected, as the seasonal conditions were more favourable to earlier maturing varieties.

FIELD EXPERIMENTS WITH WHEAT, 1929.

DAMPAWAH EXPERIMENT FARM.

I. THOMAS, Sperintendent of Wheat Farms,
and
F. GISHUBL, Farm Manager.

The farm is situated 30 miles east of Perenjori, being formerly a portion of Karara Station, held leasehold by K. Samson and Co., on the fringe of the Lower Murchison.

The soil is a red friable loam, and the area cropped last season was originally timbered mainly with York Gum, Giant Mallee, Karara, and Mulga scrub.

The clearing of the land under crop this season was completed in March, 1928. It was ploughed 3-4 inches deep during late June, July and August with an 8-disc cultivating plough. Immediately after ploughing it was cultivated with a springtyne cultivator, harrowed in January and again in February after thunderstorms. This gave a good even mulch and assisted to consolidate the subsoil.

The total rain recorded for the year (January-December) was 1,095 points. This compares favourably with the official records at Perenjori for the same period.

The following table shows the monthly falls and the number of days on which rain was recorded compared with the period for which records have been kept at the farm (since May, 1928) :—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1929 ...	17	220	64	...	267	234	60	62	18	33	674	120	...	1,095
No. of days on which rain fell	1	6	2	...	13	15	7	6	2	2	45	6	...	60
1928 ...	...	...	...	...	164	94	238	142	71	34	743	6	156	...

All the crops made rapid and strong growth until the middle of August. It will be seen from the above table that the rains during July and August were scanty.

The adverse conditions continued throughout September, and as no serviceable rain was experienced during that month the crops were seriously affected and commenced to burn off in patches. It was feared at the time that the yields would be affected even to a greater extent than was actually the case.

Rate of Seeding Experiment.

The object of this experiment is to ascertain the most economical rate at which to plant the wheat crop with—

(a) a midseason, free stooling variety;

(b) an early, sparse stooling variety.

To meet the requirements of the former the standard variety Nabawa was used, and for the latter the variety S.H.J.

Each variety, treated as a separate experiment, was planted in different sections.

DAMPAWAH EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT, 1929.

Variety—Nabawa Planted on 18th April. Superphosphate (22%)—108lbs. per acre.

Rate of Seeding.	Computed Yields per Acre.					Average Yields per acre, 1929.	Percentage Yields, 1929.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
30lbs. seed per acre	14 0	13 53	14 0	14 37	13 24	13 59	110
45lbs. seed per acre	12 11	12 47	13 2	12 33	13 9	12 44	100
60lbs. seed per acre	11 27	12 4	12 47	11 12	13 2	12 6	95

DAMPAWAH EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT, 1929.

Variety—S.H.J. Planted on 18th April. Superphosphate (22%)—108lbs. per Acre.

Rate of Seeding.	Computed Yields per Acre.					Average Yields per acre, 1929.	Percentage Yields, 1929.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
30lbs. seed per acre	14 15	13 31	14 15	13 53	14 22	14 3	102
45lbs. seed per acre	14 0	12 40	14 8	13 53	14 8	13 46	100
60lbs. seed per acre	13 9	12 55	12 11	13 9	14 8	13 6	95

These results, which are for one year only, cannot be taken as conclusive. However, they confirm the results obtained at the other experiment farms, viz., that no advantage is obtained from the heavy rates of seeding.

Time of Application of Superphosphate Experiment.

This experiment was designed to determine whether when heavy dressings of superphosphate are used it would be profitable to apply part or all of the fertiliser when cultivating the fallowed land during late summer or early autumn, so that seeding operations can be expedited.

The results for this season are as follow:—

DAMPAWAH EXPERIMENT FARM.

TIME OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT, 1929.

Variety—Gluyas Early Planted on 6th May. Seed—44lbs. per acre.

Time of application of Superphosphate.	Computed Yields per Acre. Section 1.		Section 2.		Section 3.		Section 4.		Section 5.		Average Yields per acre, 1929.		Percentage Yields, 1929.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
75lbs. in April; 150 lbs. at Seeding time	19	44	22	47	23	2	23	23	24	7	22	37	106
225lbs. in April ...	20	28	21	41	21	12	21	41	21	34	21	19	100
150lbs. in April; 75 lbs. at Seeding time	21	41	22	54	22	40	23	2	20	57	22	15	104

Although for one year only, these results are in accord with the results from other Experiment Farms, and indicated that the wheat yields are decreased when a portion of the fertiliser is applied some time prior to seeding.

Rate of Application of Superphosphate Experiment.

This experiment is divided into two sections in order to test the effects of applying the following amounts of superphosphate per acre:—

Section 1.—300 lbs. per acre.
150 lbs. per acre (Control).
225 lbs. per acre.

Section 2.—No super.
150 lbs. per acre (Control).
75 lbs. per acre.

The results confirm the findings at other experiment farms, namely, that amounts of superphosphate in excess of 75 lbs. and up to 150 lbs. per acre can profitably be applied.

DAMPAWAH EXPERIMENT FARM.

RATE OF SUPERPHOSPHATE, EXPERIMENT NO. 1, 1929.

Variety—Gluyas Early. Planted on 6th May. Seed—44lbs. per acre.

Rate of Application of Superphosphate.	Computed Yields per Acre. Section 1.		Section 2.		Section 3.		Section 4.		Section 5.		Average Yields per acre, 1929.		Percentage Yields, 1929.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
300lbs. per acre ...	23	45	22	10	21	49	20	28	19	7	21	28	102
150lbs. per acre ...	22	40	21	12	21	12	21	5	18	45	20	59	100
225lbs. per acre ...	22	32	21	27	20	21	20	50	18	38	20	46	99

DAMPAWAH EXPERIMENT FARM.

RATE OF SUPERPHOSPHATE, EXPERIMENT NO. 2, 1929.

Variety—Gluyas Early. Planted on 7th May. Seed—44lbs. per acre.

Rate of Application of Superphosphate.	Computed Yields per Acre. Section 1.		Section 2.		Section 3.		Section 4.		Section 5.		Average Yields, 1929.		Percentage Yields, 1929.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
No superphosphate	5	21	5	58	7	26	7	55	8	3	6	57	33
150lbs. per acre (Control)	20	28	20	36	21	34	21	5	20	21	20	49	100
75lbs. per acre ...	17	32	17	54	18	30	19	37	18	9	18	20	88

Nitrogen Experiment.

The objects of this experiment are—

1. To determine whether increased yields are obtained when heavy dressings of a nitrogenous fertiliser are applied to the wheat crop in addition to an application of superphosphate.
2. To ascertain whether it is advantageous to apply only part of the nitrogenous fertiliser at seeding time and part during the month of August.

For the purposes of the experiment two rates of sulphate of ammonia were applied, viz., 1 cwt. and 2 cwts. respectively.

Superphosphate was applied to all plots at the rate of 120 lbs. per acre, and those plots to which superphosphate only was applied were treated as controls. Comparisons were made between these control plots and those plots receiving 1 cwt. and 2 cwts. of sulphate of ammonia respectively. With each of these dressings the whole of the fertiliser was applied at the one time, viz., at seeding, in the one instance, and also, in separate plots, the application of half the sulphate was delayed until the month of August.

That portion of the experiment dealing with the application of 1 cwt. of sulphate of ammonia was repeated three times, while that portion dealing with the 2 cwt. of sulphate of ammonia was duplicated.

This experiment was conducted on fallowed land, the results being tabulated hereunder:—

DAMPAWAH EXPERIMENT FARM.

NITROGEN EXPERIMENT, 1929.

Fallow.

Variety—Gluyas Early. Planted on 9th May. Superphosphate (22%)—120lbs. per Acre. Seed—44lbs. per Acre.

Treatment.	Computed Yields per Acre.					Average Yields per acre, 1929.	Percentage Yields, 1929.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
½ cwt. Ammonium Sulphate at Seeding; ½ cwt. Ammonium Sulphate in August	19 14	...	18 30	...	19 44	19 9	98
No Ammonium Sulphate (Control)	19 44	...	19 0	...	19 44	19 29	100
1 cwt. Ammonium Sulphate at Seeding	19 44	...	18 45	...	18 45	19 5	98
1 cwt. Ammonium Sulphate at Seeding; 1 cwt. in August	...	18 30	...	21 27	...	19 58	101
No Ammonium Sulphate (Control)	...	18 45	...	20 57	...	19 51	100
2 cwts. Ammonium Sulphate at Seeding	...	20 14	...	19 44	...	19 59	101

These results being for one year only are not conclusive, but they indicate, as do those at the Merredin and Yilgarn farms, that little or no advantage is obtained by applying a nitrogenous fertiliser to a wheat crop on fallowed forest land in the more Eastern wheat belt.

Mulching Experiment.

This experiment is conducted in order to determine how far and under what conditions the cultivation of winter fallowed land is profitable during the spring and summer months.

Three plots were necessary to fulfil the requirements of the experiment. They were treated as follows:—

Plot No. 1.—Cultivated during spring, again when required during summer after 25 points of rain or over, and again prior to seeding, the object being to maintain a mulch throughout the fallowed period and to destroy weed growth.

Plot No. 2.—Cultivated during spring and prior to seeding only (ordinary fallow).

Plot No. 3.—Cultivated prior to seeding only (neglected fallow).

The soil on which the experiment was conducted was a red friable loam, the original timber being York Gum and Karara. This land was fallowed and cropped for the first time for this experiment.

All the plots were fallowed at the end of June, 1928, and subsequently received the following cultivations with a springtyne implement.

Plot No. 1.—Cultivated in September, October, December, January, February, March, and prior to seeding in May.

Plot No. 2.—Cultivated in September and before seeding.

Plot No. 3.—Cultivated before seeding only.

The results obtained this season are as follow:—

DAMPAWAH EXPERIMENT FARM.

MULCHING EXPERIMENT, 1929.

Variety—Gluyas Early. Planted on 4th May. Superphosphate (22%)—112lbs. per acre. Seed—44lbs. per acre.

Treatment.	Computed Yields per Acre.										Average Yields per acre, 1929.		Percentage Yields, 1929.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	,bs.	bus.	lbs.	%
Mulched before Seeding only	22	54	22	3	20	50	22	18	21	56	22	0	100
Mulched in Spring and before Seeding	22	40	22	10	22	3	19	59	22	40	21	54	100
Mulched in Spring after rain, during Summer and before planting	20	21	20	43	20	50	21	5	22	32	21	6	96

Although Plot No. 1 received five additional workings the results are no better than those from the plot worked after ploughing and before seeding only. However, the results are only for one year and cannot as yet be accepted as conclusive.

Experiments were also planted for the purpose of ascertaining the most suitable months to plant the wheat crop and also to ascertain the most prolific of the different maturing types of wheat.

It is to be regretted that the birds (galahs) so damaged the plots that the results cannot be taken for comparison.

FIELD EXPERIMENTS WITH WHEAT, 1929.

CHAPMAN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms, and
P. JEFFERY, Farm Manager.

The land on which the experiments were conducted varied from typical jam (acacia acuminata) country to that of lighter timber country and had been cleared some years previously.

The following table shows the monthly rainfall as recorded at the farm during the year, together with the averages for the past 24 years:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.						Total. May-Oct.	Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.				
1929 ...	...	40	20	10	424	643	189	190	73	35	1,554	106	3	1,663
Previous 24 years average	28	50	68	42	231	427	407	263	170	96	1,592	25	28	1,645

The seasonal rains commenced early in May, and during that and the following month the rainfall was considerably above the average for that period. The rainfall for the remaining months of the growing period, however, although below the average was sufficient for the crop to mature normally on account of the previous excessive rain.

All the experiments, unless otherwise stated, were planted on land which had been ploughed during the previous winter months (June, July and August) and was cultivated during September and October, again in March and prior to seeding.

Time of Seeding Experiment.

This experiment was commenced in 1923 and has been planted each year since with the early variety Gluyas Early, but owing to the plots being destroyed by fire in 1924 and other factors interfering with the results in 1925 and 1926, the results were not obtained for those years. Commencing in 1928, the midseason variety Nabawa was included in the experiment.

Each variety was planted as a separate experiment, the Gluyas Early being planted in mid-May, June and July, and Nabawa in mid-April, May and June.

The land was ploughed during August the previous year to a depth of 4 inches with a mouldboard plough and springtyne cultivated in September.

All the Gluyas Early plots were again cultivated when the May section was planted. The June and July plots received a further cultivation at the time the June section was planted, and the July plot was again cultivated prior to seeding.

The Nabawa plots were treated in a similar manner, that is, as each section was planted the remaining plots not planted were cultivated also. This insured the ground being free of weeds and in good tilth.

The soil was in a dry condition at the time of planting the April section of Nabawa. After the commencement of the seasonal rains, weed growth was most prominent. The May section was reasonably free, whilst the June section was free of weeds. The Gluyas Early plots were in a moist condition when planted.

The heavy rains during November caused the Gluyas Early plots planted in June to lodge slightly, whilst the July plots lodged badly. The May plots stood remarkably well. The following table shows the results obtained:—

CHAPMAN EXPERIMENT FARM.

TIME OF SEEDING EXPERIMENT, 1929.

Variety—Nabawa. Superphosphate (22%)—112lbs. per acre. Seed—45lbs per acre.

Planted.	Computed Yields per Acre.										Average Yields per acre 1929.		Percentage Yields, 1929.	Average Yields per acre 1928-29.		Percentage Yields, 1928-29.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	bus.	lb.	%
April	7	55	8	17	8	32	7	11	7	3	7	28	73	9	45	86
May (Control) ...	11	20	10	29	10	58	10	21	10	14	10	40	100	11	20	100
June	11	49	12	25	11	12	10	51	*		11	34	108	10	43	95

* Discarded owing to an accident when planting.

CHAPMAN EXPERIMENT FARM.

TIME OF SEEDING EXPERIMENT, 1929.

Variety—Gluyas Early. Superphosphate (22%)—112lbs. per acre. Seed—45lbs. per acre.

Planted.	Computed Yields per Acre.										Average Yields per acre 1929.		Percentage Yields, 1929.	Average Yields per acre 1923-29.		Percentage Yields, 1923-29.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
June	14	51	15	50	13	53	14	22	13	24	14	28	76	13	46	80
May (Control) ...	15	57	20	14	20	14	20	6	18	45	19	3	100	17	10	100
July	7	3	6	49	8	3	6	12	7	41	7	10	38	8	54	52

The results of the sections planted with the early variety Gluyas Early confirm the previous year's result, and it can be definitely concluded that best returns can be expected when early varieties are planted in May.

The results of the section planted with the midseason variety Nabawa are for two years only, and therefore no definite conclusion can be arrived at. They indicate, however, that the May planting is the most suitable, but they do not agree with the results obtained last year from the April and June plantings. It must not be overlooked that weed growth in the April plots may have accounted for this, and it would appear advisable to await the seasonal rains before planting land on which weeds are troublesome.

Rate of Seeding Experiment.

This experiment is carried out with a sparse stooling variety, S.H.J., and a free stooling variety, Yandilla King, the object being to ascertain the most economical rate at which to plant the wheat crop.

The land was ploughed during August, 1928, with a mouldboard plough. Through the winter sheep had access to the paddock and kept down the weed growth. The land was cultivated with a springtyne implement in October and again prior to seeding.

The results for this year, together with the average results for the period 1923-29, are as follow:—

CHAPMAN EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT, 1929.

Variety—Yandilla King. Planted on 6th May. Superphosphate (22%)—150lbs. per acre.

Rate of Seeding.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yields per acre 1929.		Percentage Yields, 1929.	Average Yields per acre 1923-29.		Percentage Yields, 1923-29.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
60lbs. per acre ...	8	32	7	55	7	55	7	11	8	25	8	0	112	15	29	100
45lbs. per acre (Control)	7	48	6	56	6	56	6	27	7	33	7	8	100	15	29	100
90lbs. per acre...	10	7	10	7	9	59	9	30	9	23	9	49	138	16	19	106

CHAPMAN EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT, 1929.

Hay Yields.

Planted on 6th May. Variety—Yandilla King. Superphosphate (22%)—150lbs. per acre.

—	Computed Yields per Acre. Section 1.			Section 2.			Section 3.			Average Yields per acre 1929.			Percentage Yields, 1929.	Average Yields per acre 1923–29.			Percentage Yields, 1923–29.
	C.	Q.	L.	C.	Q.	L.	C.	Q.	L.	C.	Q.	L.	%	C.	Q.	L.	%
60lbs. per acre ...	11	2	24	10	3	35	11	2	14	11	1	18	107	21	0	9	95
45lbs. per acre ...	11	0	4	10	0	21	10	3	17	10	2	28	100	22	0	14	100
90lbs. per acre ...	12	3	27	13	1	0	12	1	24	12	3	17	121	22	3	3	108

CHAPMAN EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT, 1929.

Variety—S.H.J. Planted 8th June. Superphosphate (22%)—150lbs. per acre.

Rate of Seeding.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yields per acre 1929.		Percentage Yields, 1929.	Average Yields per acre 1923-29.		Percentage Yields, 1923-29.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
60lbs. per acre	19	44	20	21	20	28	21	12	22	3	20	46	99	16	48	105
45lbs. per acre...	19	44	20	57	20	57	21	12	21	27	20	51	100	15	57	100
90lbs. per acre...	18	30	20	6	20	6	20	43	20	14	19	56	96	17	17	108

CHAPMAN EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT, 1929.

Hay Yields.

Planted on 8th June. Variety—S.H.J. Superphosphate (22%)—150lbs. per acre.

Rate of Seeding.	Computed Yields per Acre. Section 1.	Section 2.	Section 3.	Average Yields per acre, 1929.	Percentage Yields, 1929.	Average Yields per acre, 1923–29.	Percentage Yields, 1923–29.
	C. Q. L.	C. Q. L.	C. Q. L.	C. Q. L.	%	C. Q. L.	%
60lbs. per acre ...	23 0 27	22 3 26	23 1 14	23 0 22	101	25 1 9	104
45lbs. per acre ...	22 3 26	22 3 11	22 3 3	22 3 13	100	24 1 18	100
90lbs. per acre ...	26 0 12	24 1 26	24 2 5	25 0 5	110	26 2 7	109

The results this year show that in the case of both the free stooling and the sparse stooling varieties, the hay yields are increased when the heavier rates of seed are sown.

Contrary to expectations the heaviest rate of seeding for the free stooling and late maturing variety Yandilla King gave a substantial increase in yield, whilst for the sparse stooling and early variety, S.H.J., the heavier rates show no advantage over the control of 45 lbs. per acre.

This is not in accord with the average results for the previous six years.

Time of Application of Superphosphate.

This experiment was commenced in 1928 with the object of determining whether, when heavy dressings of superphosphate are used, it would be economical to apply part or all of this fertiliser when cultivating the fallowed land during late summer or early autumn, thus enabling seeding operations to be expedited.

To suit the requirements of this experiment three plots were used and each section was repeated five times.

The land on which the experiment was conducted this year was ploughed with a heavy disc plough in June the previous year. It was cultivated with a springtyne cultivator during September, again in October and again in April when the fertiliser was applied, and also on the 14th May when the seed was planted.

The detailed results obtained this year, together with the average results for the two years the experiment has been in progress, are shown hereunder:—

CHAPMAN EXPERIMENT FARM.

TIME OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT, 1929.

Variety—Nabawa. Planted on 14th May. Seed—45lbs. per acre. Superphosphate—225lbs. per acre

Time of Application of Superphosphate.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yields per acre 1929.		Percentage Yields, 1929.	Average Yields per acre 1928–29.		Percentage Yields. 1928–29.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
75lbs. in April; 150lbs. at seeding time	12	33	14	8	13	24	14	51	14	22	13	52	103	14	30	109
225lbs. in April	14	30	13	9	12	55	12	25	14	37	13	31	100	13	17	100
150lbs. in April; 75lbs. at seeding time	13	53	12	11	12	18	11	49	13	17	12	42	94	13	38	103

The experiment has not been conducted sufficiently long enough for definite conclusions to be derived.

The results for this year show that the yields are increased when the greater portion of the superphosphate is applied at seeding time. The results for the two years, however, show that the yields are decreased when portion of the fertiliser is not applied at seeding time.

Rate of Superphosphate Experiment.

The object of this experiment is to ascertain the most profitable rates of superphosphate to apply to the wheat crop.

The previous year's trials were conducted with the rates 75 lbs., 150 lbs. and 225 lbs. per acre. This year the experiment was modified to also include plots receiving no fertiliser and 300 lbs. of superphosphate.

To meet the requirements, the experiment was designed so that the three plot system could be maintained. It was therefore divided into two sections, viz.:—

Section 1, consisting of three plots which received respectively 300 lbs., 150 lbs., and 225 lbs. of superphosphate per acre.

Section 2, consisting of three plots which received respectively no superphosphate, 150 lbs. and 75 lbs. of superphosphate per acre.

The results of the experiment are shown in the following tables:—

CHAPMAN EXPERIMENT FARM.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT, No. 1, 1929.

Variety—Nabawa. Planted on 14th May. Seed—45lbs. per acre.

Rate of Application of Superphosphate.	Computed Yields per Acre.					Average Yields per acre, 1929.	Percentage Yields, 1929.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
300lbs. per acre ...	12 11	14 44	15 7	16 41	16 26	15 2	111
150lbs. per acre (Control)	11 12	14 0	13 31	14 37	14 59	13 34	100
225lbs. per acre ...	12 47	14 15	15 14	15 43	18 1	15 12	112

CHAPMAN EXPERIMENT FARM.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT, No. 2, 1929.

Variety—Nabawa. Planted on 14th May. Seed—45lbs per acre.

Rate of Application of Superphosphate.	Computed Yields per Acre.					Average Yields per acre 1929.	Percentage Yields, 1929.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
No Super.	7 11	8 54	8 10	8 3	8 3	8 4	71
150lbs. per acre (Control)	10 36	11 27	11 20	11 34	11 29	11 17	100
75lbs. per acre ...	9 1	9 1	9 59	10 29	9 52	9 40	86

As these results are for one year only, they cannot be taken as conclusive. They indicate, however, that the yields are increased by the heavier application of superphosphate.

It was not possible to conduct this experiment at this farm on land to which superphosphate had not been applied previously. Consequently the yields of the plots receiving no superphosphate this year would benefit by the residual effect of the superphosphate previously applied.

Nitrogen Experiment

The objects of this experiment are:—

1. To determine whether increased yields are obtained when heavy dressings of a nitrogenous fertiliser are applied to the wheat crop in addition to an application of superphosphate.
2. To ascertain whether it is advantageous to apply only part of this nitrogenous fertiliser at seeding time and part during the month of August.

For the purposes of the experiment two rates of sulphate of ammonia were applied, viz., 1 cwt. and 2 cwts. respectively.

Superphosphate was applied to all plots at the rate of 120 lbs. per acre, and those plots to which superphosphate only was applied were treated as controls. Comparisons were made between these control plots and those plots receiving 1 cwt. and 2 cwts. of sulphate of ammonia respectively. With each of these dressings the whole of the fertiliser was applied at the one time, viz., at seeding, in the one instance, and also, in separate plots, the application of half of the sulphate was delayed until the month of August.

That portion of the experiment dealing with the application of 1 cwt. of sulphate of ammonia was repeated six times, while that portion dealing with the 2 cwt. of sulphate of ammonia was repeated four times.

This experiment was conducted on both fallowed and unfallowed land. The fallowed land was ploughed during June, 1928, and springtyne cultivated in September. During May, prior to seeding, it was again springtyne cultivated twice. The plots were planted on the 21st of May. Germination was good, and during the months of June, July and August the plots treated with the nitrogenous fertiliser made much better growth than the control plots.

The plots treated with the sulphate of ammonia turned colour about 5 or 6 days before the control plots, but all plots matured about the same time.

The unfallowed land was ploughed with a mouldboard plough about the middle of May, this operation being followed by a springtyne cultivation.

Throughout the early spring months the sulphate of ammonia plots made better growth than the controls, the highest dressing (2 cwts. per acre) showing to particular advantage. It was further noticed that the plots treated with the nitrogenous fertiliser flowered about 4 days earlier and turned colour about 15 days earlier than did the control plots. However, maturity was even throughout, due, perhaps, to the delay caused by the late rains.

The tabulated results are shown below:—

CHAPMAN EXPERIMENT FARM.

NITROGEN EXPERIMENT, 1929.

Fallow.

Variety—Nabawa. Planted 21st May. Seed—45lbs. per acre. Superphosphate—(22%)—120lbs. per acre.

Treatment.	Computed Yields per Acre.												Average Yields per acre 1929.		Average Percentage Yields, 1929.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Sec. 6.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
½ cwt. Ammonium Sulphate at seeding; ½ cwt. Ammonium Sulphate in August	29	14	28	16	26	18	19	58	22	40	18	46	24	12	114
No Ammonium Sulphate (Control)	22	10	26	48	27	32	13	8	20	28	17	32	21	16	100
1 cwt. Ammonium Sulphate at seeding	28	16	27	32	27	32	17	48	22	24	19	58	23	55	112
1 cwt. Ammonium Sulphate at seeding; 1 cwt. Ammonium Sulphate in August	27	16	28	0	...		21	42	20	28	...		24	22	109
No Ammonium Sulphate (Control)	27	16	27	46	...		17	4	17	32	...		22	25	100
2 cwts. Ammonium Sul. at seeding	27	2	28	16	...		19	30	21	56	...		24	11	108

CHAPMAN EXPERIMENT FARM.

NITROGEN EXPERIMENT, 1929.

Non Fallow.

Variety—Nabawa. Planted on 21st May. Seed—45lbs. per acre. Superphosphate (22%)—120lbs. per acre.

Treatment.	Computed Yields per Acre.												Average Yield per acre 1929.		Average Percentage Yield 1929.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Sec. 6.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
½ cwt. Ammonium Sulphate at seeding; ½ cwt. Ammonium Sulphate in August	17	18	16	34	17	3	21	41	19	59	13	38	17	42	105
No Ammonium Sulphate (Control)	18	2	13	24	15	7	20	43	19	0	14	22	16	46	100
1 cwt. Ammonium Sulphate at seeding	19	59	14	8	15	50	22	40	20	57	16	19	18	19	109
1 cwt. Ammonium Sulphate at seeding; 1 cwt. Ammonium Sulphate in August	19	14	17	8	...		22	25	17	3	...		18	56	127
No Ammonium Sulphate (Control)	15	7	12	25	...		19	0	12	55	...		14	52	100
2 cwts. Ammonium Sulphate at seeding	20	14	17	47	...		23	28	22	10	...		20	54	141

These results, which are for one year only, and therefore not conclusive, indicate that a slight increase is obtained from non-fallowed land when 1 cwt. of nitrogenous fertiliser per acre is applied to the wheat crop at seeding time and a substantial increase when 2 cwts. are applied. However, this increase is considerably reduced if portion of either of these applications is delayed until the spring.

On the fallowed land the yield was increased to a greater extent by the 1 cwt. dressing than by the heavier dressing of 2 cwt. With both these dressings no advantage was gained by delaying portion of the applications until the spring.

Seasonal Planting Experiment.

The objects of this experiment are:—

1. To ascertain the most suitable month to plant the Late, Midseason. Early and Very Early maturing varieties of wheat.
2. To determine the most prolific of each of the above types.

To meet the requirements of the experiment three sections were needed, viz.:—

(a) Section 1.—Planted in April, representing early planting.
(b) Section 2.—Planted in May, representing Midseason planting.
(c) Section 3.—Planted in June, representing Late planting.

Each section planted in its respective month was repeated five times, all plots being eventually harvested for grain.

The standard midseason variety, Nabawa, was planted in the control plots in all sections.

April Planting.—The seed in this section was planted when the soil was in a dry condition, and consequently it did not germinate until after the seasonal rain commenced during the first week in May. At the time of planting the land was free of weed growth. With the first rain weed seeds germinated freely and in consequence interfered with the growth of the wheat crop, particularly the slow-growing late maturing variety, Yandilla King.

CHAPMAN EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT, 1929.

April Planting.

Planted 16th April, 1929. Seed—45lbs. per acre. Superphosphate (22%)—112lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre 1929.	Average percentage yields, 1929.	Average percentage yields, 1928–29.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Yandilla King ...	Late ...	10 36	8 17	6 12	7 3	7 48	7 59	65	81
Nabawa (Control)	Midseason	14 51	12 40	11 12	10 43	12 11	12 19	100	100
Baroota Wonder,	Late ...	13 53	12 11	12 11	12 40	13 38	12 55	105	101
Early Comeback ...	Early ...	11 42	9 59	9 1	8 17	11 27	10 5	104	...
Nabawa (Control)	Midseason	11 12	8 32	9 16	10 14	9 16	9 42	100	100
Gluyas Early ...	Early ...	11 42	8 54	8 17	9 23	8 3	9 16	96	98

With the exception of the Yandilla King, the results obtained this year and the average percentage results for the two years the experiment has been conducted do not show a great difference between the varieties.

May Planting.—The land at the time of planting was in excellent condition and was free of weeds. Germination was good.

The very early variety Noongar came into ear on the 15th of August and at harvest time had lodged badly.

CHAPMAN EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT, 1929.

May Planting.

Planted 22nd May, 1929. Seed—45lbs. per acre. Superphosphate (22%)—112lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre 1929.	Average percentage yields, 1929.	Average percentage yields, 1928–29.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Yandilla King ...	Late ...	16 48	14 0	14 30	14 59	19 30	15 57	93	93
Nabawa (Control)	Midseason	17 32	14 59	14 8	18 1	21 12	17 10	100	100
Baroota Wonder, Early	Late ...	16 41	15 43	15 29	19 0	20 50	17 33	102	97
Gluyas Early ...	Early ...	17 32	16 26	16 4	19 0	18 0	17 26	97	95
Nabawa (Control)	Midseason	18 9	15 43	17 17	19 0	19 59	18 2	100	100
Canberra ...	Early ...	20 14	18 1	18 45	21 12	21 19	19 54	110	102
Comeback ...	Early ...	15 43	13 46	14 8	16 4	19 0	15 44	88	...
Nabawa (Control)	Midseason	18 1	15 36	16 4	19 0	20 57	17 56	100	100
Merredin ...	Early ...	17 39	16 4	16 48	18 30	19 59	17 48	99	102
Carrabin ...	Early ...	15 36	15 36	15 43	18 9	19 37	16 56	98	99
Nabawa (Control)	Midseason	15 14	14 22	16 26	18 30	21 19	17 10	100	100
S.H.J.	Early ...	14 59	12 25	13 53	17 25	19 59	15 44	92	104
Geeralying ...	Very Early	13 24	14 15	16 34	19 0	20 14	16 41	95	92
Nabawa (Control)	Midseason	14 15	14 22	17 32	20 36	21 27	17 38	100	100
Noongaar ...	Very Early	10 36	10 43	10 29	10 29	11 5	10 40	60	79

It will be seen from both the average results for this year and the average percentage results that, apart from the very early variety Noongaar, there is not a great deal of difference between any of the varieties. This year the early variety, Canberra, has shown to advantage at this farm, but this advantage is not mantained in the average percentage results for the two years. In the latter results S.H.J. has a slight advantage.

June Planting.—At the time of planting this section weeds were plentiful and to destroy them it was found necessary to skim-plow the land with a mouldboard implement. It was also harrowed after planting to disturb them and prevent re-growth. Otherwise a good seed bed was obtained, and in consequence the germination was good. The heavy rains during November caused all varieties to lodge.

CHAPMAN EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT, 1929.

June Planting.

Planted 18th June, 1929. Seed—45lbs. per acre. Superphosphate (22%)—112lbs. yer acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre 1929.	Average percentage yields, 1929.	Average percentage yields, 1928–29.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Merredin ...	Early ...	19 14	17 32	14 30	12 18	7 19	14 11	103	90
Nabawa (Control)	Midseason	15 57	16 12	14 51	12 11	9 16	13 41	100	100
Canberra ...	Early ...	15 14	18 1	17 54	13 38	10 58	15 9	111	98
Gluyas Early ...	Early ...	13 24	15 21	14 22	11 34	10 7	12 58	103	92
Nabawa (Control)	Midseason	13 9	15 50	13 2	10 58	10 14	12 39	100	100
S.H.J.	Early ...	12 55	15 57	12 47	9 30	10 36	12 21	98	92
Geeralying ...	Very Early	14 8	16 4	12 33	7 55	10 36	12 15	98	88
Nabawa (Control)	Midseason	15 29	16 19	12 18	7 26	11 20	12 34	100	100
Noongaar ...	Very Early	14 15	14 30	9 1	7 3	10 21	11 2	88	90

It will be noticed in this year's results the early varieties have shown to advantage, whilst the very early variety Noongaar has not. The percentage results for the two years are slightly in favour of the midseason variety.

The results of the three plantings indicate that the month of May is the most suitable to plant the wheat crop, and where weeds are troublesome it is advisable to delay planting until after the seasonal rains commence.

SALMON GUMS EXPERIMENT FARM.

FIELD EXPERIMENTS WITH WHEAT, 1929.

(I. THOMAS, Superintendent of Wheat Farms, and L. G. SENIOR, Farm Manager.)

The area on which the experiments were conducted was cleared in 1926 and cropped in 1927 without fallow, and for the experiments conducted last year it was ploughed 3 to 4 inches deep with a disc implement during June and July, 1928. Included in the area was the type of soil locally known as "kopi," which physically is similar to the Morrel soil. This type is recognised as unsuitable for cropping when the rainfall is light.

Subsequent to the initial ploughing it was cross disced to destroy self-sown plants from the previous crop. This cross discing was also successful in dealing with mallee sucker growth. In January the heavier land was springtyne cultivated whilst the "kopi" soil was harrowed. Prior to seeding this cultivation was repeated with the same implement.

Although the Esperance wheat-growing area in which the farm is located did not experience the heavy rains in May and June as did other districts throughout the wheat belt, the rainfall was sufficient to ensure a good germination. Good conditions prevailed until the end of August, at which time the useful rains terminated. The land not having received sufficient heavy rains to penetrate well into the sub-soil, the reserves of moisture were limited and consequently by the end of September were suffering severely and eventually did not yield up to earlier expectations.

The following table shows the monthly rainfall for 1929 as recorded at the farm, together with the averages for the past 11 years as recorded at Salmon Gums, one mile distant.

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1929 at Experiment Farm	106	65	73	26	125	207	159	163	21	35	710	150	43	1,173
Average 11 years, Salmon Gums	81	50	112	106	154	152	135	131	115	126	813	81	81	1,274

TIME OF SEEDING EXPERIMENT.

The object of this experiment is to determine the most suitable time for planting the wheat crop.

Two varieties are used, the mid-season variety, Nabawa, being sown in April, May, and June, and the early variety, Gluyas Early, in May, June, and July.

The land on which the experiment was conducted was of a red loamy nature. It was ploughed during June and July, 1928, and cross ploughed in October. It was cultivated with a springtyne implement in January. Each plot was again cultivated immediately prior to seeding.

The results obtained are as follow:—

SALMON GUMS EXPERIMENT FARM.

TIME OF SEEDING EXPERIMENT, 1929.

Variety—Nabawa. Seed—45lbs. per acre. Superphosphate (22%)—112lbs. per acre.

Time of Seeding.	Computed Yields per Acre.										Average Yields per acre, 1929.		Percentage Yields, 1929.	Average Yields, per acre, 1928-29.		Percentage Yields, 1928-29.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
April	11	20	11	27	11	27	12	40	13	9	12	1	93	13	24	108
May	12	11	11	5	12	11	12	11	17	3	12	56	100	12	25	100
June	4	45	4	59	5	6	7	3	9	1	6	11	48	6	19	51

SALMON GUMS EXPERIMENT FARM.

TIME OF SEEDING EXPERIMENT, 1929.

Variety—Gluyas Early. Seed—45lbs. per acre. Superphosphate (22%)—112lbs. per acre.

Time of Seeding.	Computed Yields per acre.										Average Yields per acre, 1929.		Percentage Yields, 1929.	Average Yields per acre, 1928-29.		Percentage Yields, 1928-29.
	Sec .1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
June	8	25	8	32	8	39	8	3	7	48	8	17	62	10	29	78
May	13	46	13	9	13	46	13	9	12	55	13	21	100	14	15	100
July	6	56	6	34	6	5	6	27	5	50	6	22	48	8	17	58

This experiment again demonstrates that the yields of both early and mid-season varieties are considerably reduced when the crop is planted later than the month of May.

RATE OF SEEDING EXPERIMENT.

This experiment is conducted to determine the most profitable rate of seeding the wheat crop.

Two varieties were used, "Yandilla King" representing the free stooling varieties, and "S.H.J." representing the sparse stooling varieties.

The land upon which the Yandilla King was planted was mainly "kopi" soil, somewhat inferior in quality to that upon which the S.H.J. was planted.

The plots were ploughed in June and July, 1928, and cross ploughed in October to destroy self-sown wheat plants. The S.H.J. section was cultivated with a springtyne implement and the Yandilla King section harrowed the last week in January and again just before seeding.

Germination was good.

The results obtained are set out below.

SALMON GUMS EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT, 1929.

Variety—Yandilla King. Planted on 17th April. Superphosphate (22%)—112lbs. per acre.

Rate of Seeding.	Computed Yields per Acre.										Average Yields per acre, 1929.		Percentage Yields, 1929.	Average Yields, per acre, 1928-29.		Percentage Yields, 1928-29.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
30lbs. per acre	3	29	4	59	4	52	4	52	8	25	5	19	82	10	14	98
45lbs. per acre	5	43	7	3	5	50	6	41	7	19	6	31	100	10	29	100
60lbs. per acre	6	12	4	59	6	41	7	55	8	32	6	52	105	10	58	105

SALMON GUMS EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT, 1929.

Variety—S.H.J. Planted on 17th April Superphosphate (22)—112lbs. per acre.

Rate of Seeding.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yields per acre, 1929.		Per-centage Yields, 1929.	Average Yields per acre, 1928-29.		Per-centage Yields, 1928-29.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
30lbs. per acre	11	20	10	58	10	43	10	14	*		10	49	97	11	34	99
45lbs. per acre	10	58	11	34	10	51	11	12	*		11	9	100	11	42	100
60lbs. per acre	10	43	10	21	10	21	11	34	*		10	45	96	11	34	99

* Discarded owing to an error in drilling.

The results indicate that little or no advantage is derived from planting more than 45 lbs. of seed per acre.

TIME OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

This experiment is conducted in order to determine whether, when applying heavy dressings of superphosphate, it would be profitable to apply part or all of the fertiliser when cultivating the fallowed land in late summer or early autumn, thus allowing seeding operations to be expedited.

The land upon which the experiment was planted was ploughed in June, 1928. It was cross ploughed in September and October to destroy self-sown wheat. It was cultivated with a springtyne implement in January and again immediately prior to planting.

The tabulated results for 1929, together with the averages for the years 1928-29, are as follow:—

SALMON GUMS EXPERIMENT FARM.

TIME OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT, 1929.

Variety—Nabawa. Planted on 15th May. Superphosphate (22%)—225lbs. per acre.
Seed—45lbs. per acre.

Time of Application of Superphosphate.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yields per acre 1929.		Per-centage Yields 1929.	Average Yields per acre, 1928-29.		Per-centage Yields, 1928-29.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
75lbs. at Seeding; 150lbs. in March	8	46	8	54	11	27	10	51	10	29	10	5	99	13	38	104
Nil at Seeding; 225lbs. in March	8	39	8	17	9	23	11	5	13	24	10	10	100	13	9	100
75lbs. in March; 150lbs. at Seeding	9	8	10	51	10	7	13	31	14	8	11	33	114	14	44	112

The average results for the two years the experiment has been conducted show that the yields are decreased when a portion of the fertiliser is not applied at seeding time.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

This experiment has been modified and is now divided into two sections. This allows of the introduction of a plot receiving no super and one receiving 300 lbs. per acre. The object of the experiment is to determine the most profitable amount of superphosphate to apply to the wheat crop.

The land upon which the experiment was conducted was of a red loamy nature. It was ploughed in June and July, 1928, and cross ploughed in October in order to get rid of self-sown wheat.

The results obtained are tabulated below:—

SALMON GUMS EXPERIMENT FARM.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT NO. 1, 1929.

Variety—Nabawa. Planted on 12th May, 1929. Seed—45lbs. per acre.

Rate of Application of Superphosphate.	Computed Yields per Acre.					Average Yields per acre, 1929	Percentage Yields, 1929.
	Section 1.	Section 2	Section 3	Section 4.	Section 5.		
	bus. lbs.	bus. lbs	bus lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
300lbs. per acre .	16 56	16 34	13 9	10 36	9 23	13 14	117
150lbs. per acre . .	15 7	14 59	9 16	9 8	8 17	11 19	100
225lbs. per acre . .	17 10	15 43	15 57	10 51	10 58	14 8	125

SALMON GUMS EXPERIMENT FARM.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT NO. 2, 1929.

Variety—Nabawa. Planted on 14th May. Seed—45lbs. per acre.

Rate of Application of Superphosphate	Computed Yields per Acre.					Average Yields per acre, 1929.	Percentage Yields, 1929.
	Section 1	Section 2.	Section 3.	Section 4	Section 5.		
	bus. lbs.	bus. lbs	bus lbs.	bus. lbs	bus. lbs.	bus. lbs.	%
No superphosphate	4 1	5 14	4 1	4 15	7 19	4 58	32
150lbs. per acre (Control)	15 57	14 59	16 48	16 34	13 46	15 37	100
75lbs. per acre ...	13 46	14 8	14 37	14 37	14 44	14 22	93

These results, which are for one year only, tend to indicate that dressings in excess of 75 lbs. may be applied with beneficial results.

NITROGEN EXPERIMENT.

The objects of this experiment are:—

1. To determine whether increased yields are obtained when heavy dressings of a nitrogenous fertiliser are applied to the wheat crop in addition to an application of superphosphate.

2. To ascertain whether it is advantageous to apply only part of this nitrogenous fertiliser at seeding time and part during the month of August.

For the purposes of the experiment two rates of sulphate of ammonia were applied, viz., 1 cwt. and 2 cwts. respectively.

Superphosphate was applied to all plots at the rate of 120 lbs. per acre and those plots to which superphosphate only was applied were treated as controls Comparisons were made between these control plots and those plots receiving 1 cwt. and 2 cwts. of sulphate of ammonia respectively. With each of these dressings the whole of the fertiliser was applied at the one time, viz., at seeding, in the one instance, and also, in separate plots, the application of half of the sulphate of ammonia was delayed until the month of August.

That portion of the experiment dealing with the application of 1 cwt. of sulphate of ammonia was repeated three times, while that portion dealing with the 2 cwts. of sulphate of ammonia was duplicated.

This experiment was conducted on fallowed land which had been ploughed in June, 1928. It was cross ploughed in October to eradicate self-sown wheat, springtyne cultivated in January, 1929, and again immediately prior to planting.

The plots treated with the nitrogenous fertiliser made good growth until the dry spell in September, when they appeared to suffer worse than the control plots.

The results of the experiment are tabulated hereunder:—

SALMON GUMS EXPERIMENT FARM.

NITROGEN EXPERIMENT, 1929.

Variety—Nabawa. Planted on 16th May. All plots received a dressing of 120lbs. of Super. Seed—45lbs. per acre.

Treatment.	Computed Yields per Acre.					Average Yields per acre, 1929.	Percentage Yields per acre, 1929.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
½ cwt. Ammonium Sulphate at Seeding; ½ cwt. in August	11 27	...	12 55	...	12 33	12 18	91
No Ammonium Sulphate (Control)	12 47	...	13 46	...	14 0	13 31	100
1 cwt. Ammonium Sulphate at Seeding	12 25	...	13 17	..	14 22	13 21	99
1 cwt. Ammonium Sulphate at Seeding; 1 cwt. in August	...	12 25	...	14 22	...	13 23	100
No Ammonium Sulphate (Control)	...	13 24	...	13 17	...	13 20	100
2 cwts. Ammonium Sulphate at Seeding	...	13 2	...	11 20	...	12 11	91

As the experiment has been conducted for one year only, no definite conclusions can be derived. However, these results indicate that the yield is not increased by the application of a nitrogenous fertiliser to the wheat crop on fallowed land.

SEASONAL PLANTING EXPERIMENT, 1929.

The objects of this experiment are:—

1. To ascertain the most suitable month to plant the Late, Mid-season, Early, and Very Early maturing varieties of wheat.

2. To determine the most prolific of each of the above types.

To meet the requirements of the experiment, three sections were made, viz:—

(a) Section 1, Planted in April, representing early planting.

(b) Section 2, Planted in May, representing mid-season planting.

(c) Section 3, Planted in June, representing late planting.

Each section planted in its respective month was repeated five times, all plots being eventually harvested for grain.

The Standard mid-season variety was planted in the control plots in all sections.

The land on which this experiment was conducted varied from red loam to the grey "kopi" soil. The April section was planted chiefly on the former, whilst the May and June sections were planted on the latter.

The April plots were planted on a dry seed bed and consequently the seed did not germinate until rain was experienced early in May.

Both the April and May plantings germinated and stooled well. Early growth was vigorous and gave promise of good returns until the end of September. At that time dry conditions prevailed and the crops suffered considerably.

The germination of the plots in the June section was not as good. The subsequent growth was very slow and patchy and, when mature, the crop was very poor and short.

The results obtained this year together with the averages for the two years the experiment has been conducted at this farm are set out below.

SALMON GUMS EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT, 1929.

April Planting.

Seed—45lbs. per acre. Superphosphate—112lbs. per acre.

Variety.	Maturity.	Computed Yield per Acre.					Average Yield per acre, 1929.	Average per-centage Yield, 1929.	Average per-centage Yield, 1928-29.
		Section 1.	Section 2.	Section 3.	Section 4.	Section 5.			
		bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	%
Yandilla King ...	Late ...	7 33	10 7	10 51	7 3	6 49	8 29	74	83
Nabawa	Midseason ...	10 14	11 12	12 18	11 20	12 18	11 28	100	100
Baroota Wonder Early	Midseason ...	9 52	10 21	10 43	7 48	7 55	9 20	82	91
Canberra	Early ...	11 56	12 11	13 9	12 25	12 25	12 25	106	97
Nabawa	Midseason ...	10 29	11 42	12 33	11 56	11 42	11 40	100	100
Merredin	Early ...	10 51	11 56	12 47	10 51	11 20	11 33	99	86
Gluyas Early ...	Early ...	10 21	10 58	12 11	12 11	10 51	11 18	96	...
Nabawa	Midseason ...	10 43	11 12	13 9	11 42	12 18	11 45	100	100
Noongaar	Very Early...	7 48	9 45	9 38	10 14	8 10	9 7	77	...

SALMON GUMS EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT, 1929.

May Planting.

Seed—45lbs. per acre. Superphosphate—112lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yield per acre, 1929.	Average per-centage Yields, 1929.	Average per-centage Yields, 1928-29.
		Section 1.	Section 2.	Section 3.	Section 4.	Section 5.			
		bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	%
Yandilla King ...	Late ...	5 36	4 23	4 37	2 48	2 12	3 55	42	70
Nabawa	Midseason ...	10 58	9 30	10 7	7 3	8 39	9 15	100	100
Merredin	Early ...	10 43	10 43	9 45	7 26	9 59	9 43	105	...
Baroota Wonder Early	Midseason ...	5 14	4 52	3 46	3 10	4 23	4 17	49	63
Nabawa	Midseason ...	10 21	9 16	9 1	6 5	8 54	8 43	100	100
Canberra	Early ...	9 16	8 46	7 26	6 12	9 59	8 20	96	96
Gallipoli	Late Mid-season	6 12	7 55	4 59	3 24	5 21	5 34	65	88
Nabawa	Midseason ...	9 30	10 7	8 3	4 59	10 7	8 33	100	100
Gluyas Early ...	Early ...	9 45	10 29	8 17	6 12	8 32	8 39	101	97
Carrabin	Very Early	7 48	9 30	7 41	6 34	7 33	7 49	99	94
Nabawa	Midseason ...	9 30	9 16	7 41	5 58	7 3	7 54	100	100
S.H.J.	Very Early...	8 3	8 17	6 34	5 14	8 3	7 14	92	92
Geeralying ...	Very Early ...	8 3	8 39	6 49	5 21	7 11	7 13	95	97
Nabawa	Midseason ...	9 16	9 1	6 49	4 52	8 3	7 36	100	100
Noongaar	Very Early...	8 3	10 7	7 26	5 50	9 30	8 11	108	105

SALMON GUMS EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT, 1929.

June Planting.

Seed—45lbs. per acre. Superphosphate—112lbs. per acre.

Variety.	Maturity.	Computed Yield per Acre.					Average Yields per acre, 1929.	Average percentage Yields, 1929.	Average percentage Yield, 1928-29.
		Section 1.	Section 2.	Section 3.	Section 4.	Section 5.			
		bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	%
Yandilla King ...	Late ...	3 53	3 46	3 17	5 50	4 8	4 11	89	...
Nabawa	Midseason ...	3 24	4 59	3 24	6 41	5 6	4 43	100	100
Canberra	Early ...	5 36	4 59	4 15	7 26	5 36	5 34	118	111
Baroota Wonder Early	Midseason ...	3 24	2 55	2 40	5 6	3 24	3 30	69	...
Nabawa	Midseason ...	4 59	4 37	4 15	7 3	4 45	5 8	100	100
Gluyas Early ...	Early ...	6 27	5 50	6 5	8 3	6 41	6 37	129	118
S.H.J.	Very Early ...	4 23	4 52	4 45	6 49	5 14	5 13	102	87
Nabawa	Midseason ...	5 14	5 14	4 30	6 27	4 15	5 8	100	100
Merredin	Early ...	5 14	5 14	4 45	6 41	6 27	5 40	112	109
Geeralying ...	Very Early...	5 28	5 21	5 36	6 34	6 56	5 59	115	104
Nabawa	Midseason ...	4 59	4 59	3 53	5 50	6 12	5 11	100	100
Noongaar	Very Early...	6 12	6 27	7 41	8 3	9 30	7 33	146	119

In all three sections there is not a great difference between the yields obtained from the standard mid-season variety and those obtained from the early and very early maturing varieties in their respective plantings, except in the case of the early variety, Noongaar, planted in April.

In view of past experience elsewhere, however, when the yields of the early maturing varieties planted in April have been reduced almost to failure in some instances, by the disease Septoria, which is due to the crop being planted too early and maturing out of season, it is inadvisable to commence planting these early varieties before the first week in May.

This year, owing to the absence of spring rains, the season was more favourable for the normal maturity of the early varieties. As the mid-season variety has, up to the present, shown its suitability for April planting, it is recommended for early planting in this district.

FIELD EXPERIMENTS WITH WHEAT AND OATS, 1929.

MERREDIN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms, and
J. H. LANGFIELD, Farm Manager.

The total rainfall for the year was 14.41 inches, the average over the past 19 years being 11.85 inches. The following table shows the rainfall for each month, together with the average over a period of 19 years:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.						May to Oct.	Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.				
1929 ...	50	162	77	...	357	309	119	94	13	35	927	220	5	1,441
Avge. 19 years	55	56	110	71	134	177	184	134	91	75	795	44	54	1,185

It will be noticed that the rainfall during the growing period is 1.32 inches above the average, and would indicate that an exceptionally good season had been experienced; but on examining the figures it will be seen that 6.66 inches fell during May and June, whilst for August, September and October, those critical months when the wheat is coming into ear and filling, only 1.42 inches were recorded. September, which is nearly always an anxious month, only yielded 13 points which were registered in four falls and were of very little value. Against the total of 14.41 inches 2.20 inches fell during November, after the crop was ripe, doing a considerable amount of harm, especially to the oat crop.

Time of Seeding Experiment.

This experiment has been conducted for the past seven years with Gluyas Early planted mid-May, June and July. Last year it was decided to conduct the experiment to include a midseason variety, to be planted mid-April, May and June.

The mid-April plots were planted on the 16th of that month, but as no rain fell until the 1st of May, germination took place only two weeks before the May planted plots.

The land was ploughed in June, 1928, to a depth of 4 inches, cultivated with a springtyne cultivator in September, harrowed after 1½ inches of rain in February and cultivated with a springtyne in April. The May, June and July plots were cultivated before planting.

The results obtained this year, together with the average results of past years are as under:—

MERREDIN EXPERIMENT FARM.

TIME OF SEEDING EXPERIMENT, 1929.

Variety—Nabawa. Superphosphate—120lbs. per acre. Seed—45lbs. per acre.

Planted.	Computed Yields per Acre.					Average Yields per acre, 1929.	Percentage Yields, 1929.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
April	20 21	22 18	22 54	22 32	24 22	22 29	100
May	22 54	21 5	22 40	21 56	23 16	22 22	100
June	11 27	11 56	14 0	14 37	17 54	13 59	68

MERREDIN EXPERIMENT FARM.

Variety—Gluyas Early. Superphosphate—112lbs. per acre. Seed—45lbs. per acre.

Planted.	Computed Yields per Acre.					Average Yields per acre 1929.	Percentage Yields, 1929.	Average Yields per acre 1923-29.	Percentage Yields, 1923–29.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
June	18 16	20 50	23 45	18 45	16 56	19 42	67	19 4	77
May	27 24	28 45	30 5	30 13	29 36	29 13	100	24 51	100
July	9 45	11 49	13 24	9 16	10 58	11 2	38	12 18	50

The results obtained with both varieties confirm those of previous years, the conclusion being that it is inadvisable to extend the planting period to the month of June. If it is not possible to complete the seeding during the month of May, it is better to plant a suitable midseason variety in April.

Rate of Seeding Experiment.

As in previous years this experiment was carried out with two varieties, viz. Nabawa, representing the free stooling varieties, and Noongaar, representing the sparse stooling varieties.

The land was ploughed in June, 1928, to a depth of 4 inches with a heavy disc plow, cultivated in September, harrowed after 1½ inches of rain in February, and springtyne cultivated in April and before planting.

The results are as under:—

MERREDIN EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT, 1929.

Variety—Nabawa. Planted on 8th May. Superphosphate (22%)—120lbs. per acre.

Rate of Seeding.	Computed Yields per Acre.					Average Yields per acre 1929.	Percentage Yields, 1929.	Average Yields per acre 1913–29.	Percentage Yields. 1913–29.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
30lbs. per acre ...	24 22	21 34	22 3	21 34	19 30	21 49	97	18 38	97
45lbs. per acre ...	22 25	23 23	23 9	22 54	20 57	22 34	100	19 37	100
60lbs. per acre ...	23 16	23 31	23 16	21 56	21 12	22 38	100	19 37	100

MERREDIN EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT, 1929.

Variety—Noongaar. Planted on 17th June. Superphosphate (22%)—120lbs. per acre.

Rate of Seeding.	Computed Yields per Acre.					Average Yields per acre 1929.	Percentage Yields, 1929.	Average Yields per acre 1913–29.	Percentage Yields 1913–29.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
30lbs. per acre	14 44	12 47	11 42	14 30	13 53	13 31	89	17 32	97
45lbs. per acre	15 43	14 37	14 37	15 21	15 43	15 12	100	18 9	100
60lbs. per acre	15 21	15 14	15 43	16 19	16 12	15 46	104	17 39	97

From the results obtained at this farm in this and previous years, it is apparent that it is unnecessary to sow either the sparse or the free stooling varieties at a rate higher than 45 lbs. per acre.

Time of Application of Superphosphate.

The object of this experiment is to determine whether, when heavy dressings of superphosphate are applied, it would be profitable to apply part or whole of the amount when cultivating the fallowed land during late summer or early autumn.

The land was ploughed in June, 1924, with a disc plough to a depth of 4 inches. It was springtyne cultivated in September, harrowed after rain in February, springtyne cultivated in April and again immediately prior to

The layout of the experiment and the results obtained are given below:—

MERREDIN EXPERIMENT FARM.

TIME OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT, 1929.

Variety—Gluyas Early. Planted on 22nd May. Seed—45lbs. per acre.

Rate of Superphosphate.	Computed Yields per Acre.					Average Yield per acre 1929.	Percentage Yields, 1929.	Average Yield per acre 1928–29.	Percentage Yields, 1928–29.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
150lbs. Super in March; 75lbs. at seeding	25 57	24 0	24 22	24 44	25 20	24 53	105	21 49	105
225lbs. Super in March	22 54	23 53	22 25	24 36	24 7	23 35	100	20 43	100
75lbs. Super. in March; 150 lbs. at seeding	24 36	25 57	25 6	27 10	27 2	25 58	110	22 25	108

These results confirm those of the previous year, indicating, as they do, that the yields of the wheat crop are decreased when portion of the fertiliser is not applied at seeding time.

Rate of Application of Superphosphate Experiment.

Last year it was decided to enlarge this experiment so as to ascertain in what proportion a greater rate of superphosphate, up to 300 lbs., would affect the yield, although it was not anticipated that it would be profitable to apply that quantity. It was also decided to include a zero plot having no superphosphate.

In order to preserve the three-plot system this experiment was divided into two sections, in each of which plots treated with 150 lbs. of superphosphate per acre were regarded as controls. Thus in section 1 the rates of 300 lbs and 225 lbs. per acre were compared with the control rate of 150 lbs. per acre, and in section 2 the rates of no superphosphate and 75 lbs. were compared with the control rate.

From the yields on the plots where no superphosphate was applied, it is evident that the crop was benefiting from the residual effects of previous dressings, but as this plot falls on the same place each year, any residue in the soil should eventually become exhausted.

The land was ploughed in June, 1928, to a depth of 4 inches, cultivated with a springtyne cultivator in September, harrowed after 1½ inches of rain in February, cultivated with a springtyne in April and again before planting.

The results obtained are shown hereunder:—

MERREDIN EXPERIMENT FARM.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT, 1929.

Variety—Gluyas Early. Planted 22nd May, 1929. Seed—45lbs. per acre.

Rate of Application of Superphosphate.	Computed Yields per Acre.										Average Yields per acre 1929.		Percentage Yields, 1929.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
300lbs. per acre ...	24	36	27	10	26	4	26	4	23	53	25	33	101
150lbs. per acre (Control)	26	26	25	49	25	35	25	20	23	23	25	19	100
225lbs. per acre ...	26	19	26	33	25	57	25	57	22	18	25	25	100

MERREDIN EXPERIMENT FARM.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT, 1929.

Variety—Gluyas Early. Planted on 22nd May. Seed—45lb. per acre.

Rate of Application of Superphosphate.	Computed Yields per Acre.										Average Yields per acre 1929.		Percentage Yields, 1929.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
No Super.	20	36	21	41	20	21	21	12	16	19	20	2	74
150lbs. per acre (Control)	27	17	27	54	26	55	27	54	26	11	27	14	100
75lbs. per acre ...	26	26	27	10	24	29	22	40	24	71	25	7	92

These results indicate that applications of superphosphate in excess of 75 lbs. and up to 150 lbs. per acre may be applied with profit. They further indicate that it is not profitable to apply superphosphate to the wheat crop in considerable excess of 150 lbs. per acre.

Nitrogen Experiment.

The objects of this experiment are—

1. To determine whether increased yields are obtained when heavy dressings of a nitrogenous fertiliser are applied to the wheat crop in addition to an application of superphosphate.
2. To ascertain whether it is advantageous to apply only part of the nitrogenous fertiliser at seeding time and part during the month of August.

For the purposes of the experiment two rates of sulphate of ammonia were applied, viz., 1 cwt. and 2 cwts. respectively.

Superphosphate was applied to all plots at the rate of 120 lbs. per acre and those plots to which superphosphate only was applied were treated as controls. Comparisons were made between these control plots and those plots receiving 1 cwt. and 2 cwts. of sulphate of ammonia respectively. With each of these dressings the whole of the fertiliser was applied at the one time—viz., at seeding, in the one instance, and also, in separate plots, the application of half the sulphate was delayed until the month of August.

That portion of the experiment dealing with the application of 1 cwt. of sulphate of ammonia was repeated six times, while that portion dealing with the 2 cwt. of sulphate of ammonia was repeated four times.

This experiment was conducted on both fallowed and unfallowed land.

The results obtained are tabulated below:—

MERREDIN EXPERIMENT FARM.

NITROGEN EXPERIMENT, 1929.

Fallowed Land.

Planted 30th May, 1929. Seed—45lbs. per acre. Superphosphate—120lbs. per acre on all Plots.

Treatment.	Computed Yields per Acre.						Average Yield per acre 1929.	Percentage Yield, 1929.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Sec. 6.		
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%
½ cwt. Ammonium Sulphate at seeding, ½ cwt. Ammonium Sulphate in August	20 28	21 41	19 0	18 1	17 32	15 36	18 43	99
No Ammonium Sulphate (Control) ...	21 27	21 12	19 14	18 30	18 30	14 51	18 57	100
1 cwt. of Ammonium Sulphate at seeding ...	20 43	18 45	19 14	17 32	18 45	18 45	18 58	100
½ cwt. Ammonium Sulphate at seeding, 1 cwt. Ammonium Sulphate in August	19 0	20 28	...	18 45	14 37	...	18 12	101
No Ammonium Sulphate (Control) ...	18 30	18 30	...	17 47	17 3	...	17 58	100
2 cwts. Ammonium Sulphate at seeding ...	18 45	20 28	...	17 17	19 14	...	18 56	105

MERREDIN EXPERIMENT FARM.

NITROGEN EXPERIMENT, 1929.

Unfallowed Land.

Planted 30th May, 1929. Seed—45lbs. per acre. 120lbs. of Superphosphate per acre on all Plots.

Treatment.	Computed Yields per Acre.						Average Yield 1929.	Percentage Yields. 1929.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec 4.	Sec. 5.	Sec. 6.		
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%
½ cwt. of Ammonium Sulphate at seeding ½ cwt. of Ammonium Sulphate in August	19 30	19 30	17 3	12 25	12 25	13 38	15 45	105
No Ammonium Sulphate (Control) ...	16 4	20 57	17 32	9 45	13 53	12 11	15 4	100
1 cwt. Ammonium Sulphate at seeding ...	15 7	19 0	12 11	10 14	14 22	10 14	13 31	89
1 cwt. of Ammonium Sulphate at seeding 1 cwt. of Ammonium Sulphate in August	20 43	17 3	...	15 7	13 9	...	16 30	105
No Ammonium Sulphate (Control) ...	19 59	17 3	...	12 55	13 9	...	15 46	100
2 cwts. of Ammonium Sulphate at seeding ...	16 48	19 0	...	10 58	15 7	...	15 28	98

These results, being for one year only, are not conclusive. However, they indicate that no substantial increase in yield is obtained either from fallowed or unfallowed land of this type when a nitrogenous fertiliser is applied to the wheat crop.

Seasonal Planting Experiment.

To meet the requirements of this experiment, three sections were needed, viz.:—

(a) Section 1, planted in April, reprsenting early planting.

(b) Section 2, planted in May, representing midseason planting.

(c) Section 3, planted in June, representing late planting.

Each section, planted in its respective month, was repeated five times, all plots being eventually harvested for grain.

The objects of this experiment are:—

1. To ascertain the most suitable month to plant the Late, Midseason and Early maturing varieties of wheat.
2. To determine the most prolific of each of the three types.

The arrangement of the experiment was similar to that of last year, the control plots, of the variety Nabawa, all being planted in the respective months of the three sections.

The land on which the experiment was conducted was heavy salmon gum and gimlet country. It was ploughed to a depth of 4 inches in June, 1928, springtyne cultivated in September, harrowed after rain in February, springtyne cultivated in May and again just before planting.

The tabulated results are shown hereunder:—

MERREDIN EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT, 1929—APRIL PLANTING.

Seed—45lbs. per acre. Planted 21st April, 1929. Superphosphate (22%)—120lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre 1929.	Percentage Yields 1929.	Average Percentage Yields 1928–29.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Yandilla King ...	Late ...	15 29	8 32	7 3	10 14	6 34	8 34	41	63
Nabawa (Control)	Midseason	22 18	19 37	19 0	20 50	21 49	20 41	100	100
Bencubbin ...	Midseason	23 2	21 5	21 56	23 16	25 20	22 56	110	...
Baroota Wonder Early	Late ...	9 59	7 3	5 28	6 5	5 58	6 54	35	...
Nabawa (Control)	Midseason	20 28	20 28	14 8	20 57	21 27	19 29	100	100
Gluyas Early ...	Early ...	19 59	20 43	20 43	22 10	23 2	21 19	109	100
Canberra ...	Early ...	22 40	21·56	22 3	22 3	23 9	22 22	109	104
Nabawa (Control)	Midseason	20 57	21 5	19 59	19 52	20 14	20 25	100	100
Carrabin	Early ...	15 50	20 28	20 50	19 0	15 29	18 19	89	86

MERREDIN EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT, 1929—MAY PLANTING.

Seed—45lbs. per acre. Planted 21st May, 1929. Superphosphate (22%)—120lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre 1929.	Percentage Yields, 1929.	Average Percentage Yields, 1928–29.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Yandilla King ...	Late ...	17 3	16 41	18 38	15 21	17 3	16 57	74	68
Nabawa (Control)	Midseason	23 53	23 53	23 2	21 41	22 40	23 2	100	100
Bencubbin ...	Midseason	26 26	26 19	26 41	25 28	24 15	25 58	112	...
Baroota Wonder, Early	Late ...	11 27	10 43	13 17	11 34	13 46	12 9	54	...
Nabawa (Control)	Midseason	21 12	23 45	23 2	22 40	21 27	22 25	100	100
Carrabin ...	Early ...	21 12	24 0	24 36	23 16	20 43	22 45	102	98
Merredin ...	Early ...	22 25	25 6	24 0	24 22	23 45	23 56	107	110
Nabawa (Control)	Midseason	21 5	24 15	23 2	21 19	22 25	22 25	100	100
Canberra ...	Early ...	24 22	27 2	28 8	24 22	25 35	25 54	116	118
Gluyas Early ...	Early ...	24 0	24 29	26 11	23 45	23 38	24 25	114	112
Nabawa (Control)	Midseason	20 57	21 41	20 50	20 43	23 9	21 28	100	100
S.H.J.	Early ...	20 43	23 16	20 21	21 27	20 6	21 11	99	95
Geeralying ...	Very Early	21 27	22 32	19 37	19 37	19 14	20 29	98	102
Nabawa (Control)	Midseason	22 3	22 32	20 28	19 44	19 44	20 54	100	100
Noongaar ...	Early ...	26 41	23 16	25 13	23 23	23 45	24 28	117	111

MERREDIN EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT, 1929—JUNE PLANTING.

Seed—45lbs. per acre. Planted 21st June, 1929. Superphosphate (22%)—120 lbs.per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre 1929.	Percentage Yields, 1929.	Average Percentage Yields, 1928–29.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Carrabin ...	Early ...	17 54	15 43	14 8	13 38	15 43	15 25	102	97
Nabawa (Control)	Midseason	15 29	16 48	13 38	13 46	15 57	15 8	100	100
Gluyas Early ...	Early ...	18 45	18 45	16 12	14 59	17 32	17 15	115	115
Canberra ...	Early ...	15 21	15 36	12 40	13 9	17 39	14 53	99	106
Nabawa (Control)	Midseason	15 50	15 36	13 31	14 44	15 29	15 2	100	100
Merredin ...	Early ...	15 7	14 37	13 24	14 30	16 26	14 49	99	102
S.H.J.	Early ...	12 40	12 25	10 51	11 34	12 47	12 3	73	79
Nabawa (Control)	Midseason	17 32	17 25	15 29	13 53	13 23	16 32	100	100
Geeralying ...	Very Early	13 24	12 47	15 14	13 33	14 51	13 59	85	93
Noongaar ...	Very Early	17 17	13 46	15 14	16 41	17 3	16 0	105	108
Nabawa (Control)	Midseason	16 46	13 46	15 14	16 12	13 53	15 11	100	100

From these results it will be seen how risky it is to plant late maturing varieties in these areas, especially on heavy land. Yandilla King, which gives excellent results in districts where the spring rains are more favourable, was, like Baroota Wonder Early, altogether too late. Both these varieties made splendid growth until September, but could not withstand the dry conditions which prevailed from then on. The midseason and early varieties which were further advanced and not carrying so much foliage at the period were not so seriously affected.

The early maturing varieties show to particular advantage in the May and June plantings. The outstanding feature regarding the yields of this experiment is the high place occupied by the standard early variety, Gluyas Early, whether planted in April, May or June.

In the April planting the new midseason variety, Bencubbin, shows to considerable advantage.

Past experience has shown that in normal years it is inadvisable to plant early varieties in April, the midseason varieties being more suitable for planting in this month.

Oat Variety Trial.

This experiment has been conducted for the past seven years. However, this year the variety Mulga has been substituted for Burt's Early as a control. Also this year's trial has been conducted with early and midseason varieties only, the later maturing varieties having, in the past, proved altogether unsuitable for the district.

The experiment comprised both hay and grain sections, six varieties being included in the latter and five in the former. The early maturing variety, Palestine, being a grain variety only, was not planted in the hay section.

The land for the experiment was ploughed in June, 1928, springtyne cultivated in September, harrowed after rain in February and again springtyne cultivated in April.

All plots made splendid growth, the midseason varieties carrying a dense quantity of foliage. These, however, suffered considerably during the dry spell in September, but the earlier varieties, being more advanced, were not so badly affected.

The yields obtained from both the hay and grain sections are as follow:—

MERREDIN EXPERIMENT FARM.

OAT VARIETY TRIAL, 1929.

Grain Section.

Seed—45lbs. per acre. Planted 23rd April, 1929. Superphosphate—120lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre 1929.	Percentage Yields, 1929.	Average Percentage Yields, 1923-29.
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Mulga (Control)	Early ...	37 33	33 33	29 32	34 36	32 22	33 31	100	100
Palestine ...	Early ...	36 15	33 33	23 37	40 8	30 29	33 0	98	...
Burts Early ...	Early ...	27 38	27 16	18 11	23 37	20 33	23 27	69	80
Gidgee	Midseason	36 8	16 33	21 37	14 32	20 26	22 3	64	...
Guyra	Midseason	28 27	11 36	17 15	15 36	16 33	18 5	52	82
Belar	Midseason	30 29	21 37	17 15	12 10	24 27	21 16	61	...
Mulga (Control)	Early ...	37 26	36 37	36 0	39 20	28 20	35 29	100	100

MERREDIN EXPERIMENT FARM.

OAT VARIETY TRIAL, 1929.

Hay Section.

Seed—45lbs. per acre. Planted 23rd April, 1929. Superphosphate—120lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre. Section 1.	Section 2.	Section 3.	Average Yield, 1929.	Percentage Yield, 1929.	Percentage Yield, 1923-29.
		C. Q. L.	C. Q. L.	C. Q. L.	C. Q. L.	%	%
Mulga (Control) ...	Early ...	56 3 4	58 3 14	53 3 18	56 2 3	100	100
Burts Early ...	Early ...	55 0 16	52 3 7	48 1 6	52 0 10	92	90
Gidgee	Midseason ...	55 3 22	51 2 1	50 1 2	52 2 7	93	...
Guyra	Midseason ...	50 2 18	46 0 10	48 0 5	48 1 1	87	92
Belar	Midseason ...	52 3 7	49 2 13	47 1 16	49 3 21	90	...
Mulga (Control) ...	Early ...	58 1 18	54 3 2	52 2 20	55 1 4	100	100

These results indicate the superiority of the early maturing variety, Mulga, for both hay and grain in early districts. In view of the adverse season, this trial further demonstrates the drought-resisting qualities of this variety.

FIELD EXPERIMENTS WITH WHEAT AND OATS, 1929.

WONGAN HILLS LIGHT LANDS FARM.

I. THOMAS, Superintendent of Wheat Farms, and
A. R. VENTON, Farm Manager.

The table hereunder shows the monthly rainfall for 1929 as recorded at the farm, together with the averages for the past 17 years as officially recorded at Wongan Hills township, four miles distant.

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1929 at Experiment Farm	22	217	85	*Nil*	261	426	172	140	35	141	1,175	38	4	1,541
1928 at Experiment Farm	76	*Nil*	28	79	124	109	319	169	96	35	852	5	36	1,076
Average 17 years including 1929	44	55	97	62	196	306	273	195	126	94	1,190	39	49	1,536

The season was not a favourable one for this class of land, and none of the crop came up to expectations. This was particularly the case with the oats and the late sown early-maturing varieties of wheat.

During May and June the rainfall was much greater than is usual for that period, and from then on was much below the average. The two extremes effectually prevented heavy yields, as the growth of the crops was retarded in the early stages by the excessive wet and cold. Whilst the October rains were slightly above the average for the month, only a little over a quarter of an inch was effective, the balance being too late, as most of the crop had matured rapidly during the warm dry spell in the latter part of August and September, and was past the stage when rain would have been beneficial.

All the experiments, unless otherwise stated, were planted on fallowed land which had not previously been cropped, the initial ploughing and clearing being done in the one operation.

Time of Seeding Experiment.

This experiment is being conducted to determine the most suitable month for planting the wheat crop in this district.

The early maturing variety, Gluyas Early, and the midseason-maturing variety, Nabawa, were used, the former being planted in May, June and July, and the latter in April, May and June. The land on which the experiment was conducted was of a gravelly nature. It was ploughed during June and July of 1928, disced during August and September, and again in March. Prior to seeding it was springtyne cultivated.

With both varieties the earliest sown plots appeared to advantage, throughout the season, with the Nabawa the disparity between the April and May sowings was very much less marked than between the May and June sowings. With the early variety, Gluyas Early, the May sowing had a very decided advantage over the later planting.

Tabulated results are given below:—

WONGAN HILLS LIGHT LANDS FARM.

TIME OF SEEDING EXPERIMENT, 1929.

Variety—Nabawa. Superphosphate (22%)—153lbs. per acre. Seed—43lbs. per acre.

Time of Planting.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yields per acre 1929.		Percentage Yields 1929.	Average Yields per acre, 1928-29.		Percentage Yields, 1928-29.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
April	12	18	13	17	13	46	14	15	13	31	13	27	120	16	34	108
May (Control) ...	10	43	11	20	11	42	11	20	11	5	11	14	100	15	21	100
June	3	39	3	53	4	1	4	1	3	53	3	53	35	6	5	37

WONGAN HILLS LIGHT LANDS FARM.

TIME OF SEEDING EXPERIMENT, 1929.

Variety—Gluyas Early. Superphosphate (22%)—153lbs. per acre. Seed—44lbs. per acre.

Time of Planting.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yields per acre, 1929.		Percentage Yields, 1929.	Average Yields per acre, 1928-29.		Percentage Yields, 1928-29.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
June	3	24	2	48	3	2	3	24	3	10	3	9	43	6	49	48
May (Control) ...	7	3	7	3	7	26	7	41	7	26	7	20	100	14	15	100
July	1	20	1	35	1	42	1	35	1	20	1	30	20	5	36	39

These results confirm in no uncertain manner those of last year, viz., that it is essential that seeding operations should be completed before the end of May.

Rate of Seeding Experiment—Wheat.

As was the case in previous years, this experiment was conducted with two varieties, Nabawa (midseason maturing), representing the free stooling, and S.H.J. (early maturing), representing the sparse stooling types respectively.

The experiment was conducted on gravelly soil originally covered with low scrub and a little York Road poison. It was ploughed during June and July of the previous year, cross ploughed with the same implement during August and September, and disc cultivated during March and April. A springtyne cultivation preceded the planting on the 27th of May. Superphosphate was applied at the rate of 153 lbs. per acre.

The germination was fair, but the growth was very slow and patchy. However, as the plots approached maturity they became more even in appearance, although very short. Stooling was poor, although as would be expected, better with the Nabawa than with the S.H.J.

Early in the season the lowest rate of Nabawa appeared at a decided disadvantage but, as the season advanced, it improved gradually. Subsequent to the middle of August the heavier seeded plots appeared to be more affected by the dry spell which was experienced.

The tabulated results of both varieties for the past season and the average results for 1925-29 are given below:—

WONGAN HILLS LIGHT LANDS FARM.

RATE OF SEEDING EXPERIMENT, 1929—WHEAT.

Variety—Nabawa. Planted on 27th May. Superphosphate (22%)—153lbs. per acre.

Rate of Seeding.	Computed Yields per Acre.										Average Yields. per acre, 1929.		Percentage Yields, 1929.	Average Yields per acre, 1925-29.		Percentage Yields, 1925-29.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
60lbs. per acre ...	8	10	8	17	7	48	7	19	8	3	7	55	101	15	29	102
45lbs. per acre ...	7	48	7	33	7	55	8	10	7	41	7	49	100	15	14	100
90lbs. per acre ...	8	39	8	32	8	10	7	26	8	10	8	11	105	15	14	100

WONGAN HILLS LIGHT LANDS FARM.

RATE OF SEEDING EXPERIMENT, 1929—WHEAT.

Variety—S.H.J. Planted on 27th May. Superphosphate (22%)—153lbs. per acre.

Rate of Seeding.	Computed Yields per Acre.										Average Yields. per acre, 1929.		Percentage Yields, 1929.	Average Yields per acre, 1925-29.		Percentage Yields, 1925-29.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
60lbs. per acre ...	7	26	7	11	7	33	7	3	7	48	7	24	114	13	9	104
45lbs. per acre ...	6	41	6	5	6	34	6	34	6	41	6	31	100	12	40	100
90lbs. per acre ...	7	41	7	19	7	48	7	41	8	10	7	44	119	13	24	106

These results confirm those of previous years, viz., that with a free stooling variety of wheat no advantage is gained by seeding more than 45 lbs. of seed per acre. With a sparse stooling variety, however, the rate may be increased above 45 lbs. with some little advantage, but no benefit is derived by planting at a rate greater than 60 lbs. per acre.

Time of Application of Superphosphate Experiment.

The object of this experiment is to determine whether, when heavy dressings of superphosphate are used, it would be profitable to apply part or all of the fertiliser when cultivating the fallowed land during late summer or early autumn so that the seeding operations can be expedited.

The land on which the experiment was conducted was of the smoke-bush and tussocky types of plain. It was ploughed 4in. deep with a disc implement during June and July, 1929. It was cross ploughed with the same implement during August and September, and disced to a depth of about two inches during March and April. Immediately prior to planting the land was springtyne cultivated. In spite of the working the land was not in the desired condition at the time of seeding. Insufficient moisture during the fallowed period hindered the work of dealing with the tussocks and of breaking down the soil and consolidating the seed bed. As a result of this condition, germination was rather uneven. This was perhaps more noticeable on the plots where all the superphosphate was applied during

March. Throughout the season growth was very slow, the crop was short and uneven and the stooling poor. In appearance the plots showed little difference, those on which all the superphosphate had been applied in March being but little behind the remainder.

The results obtained this season are given below:—

WONGAN HILLS LIGHT LAND FARM.

TIME OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT, 1929.

Variety—Nabawa. Planted on 18th May. Seed—43lbs. per acre.

Time of Application of Superphosphate.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1929.	Percentage Yields, 1929.	Average Yields per acre, 1928-29.	Percentage Yields, 1928-29.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
75lbs. Super in in March ... 150lbs. at Seeding	8 25	8 46	9 1	8 39	8 25	8 39	136	18 1	119
225lbs. in March	*	7 3	6 19	6 5	6 5	6 23	100	15 7	100
150lbs. Super in March ... 75lbs. at Seeding	7 48	7 41	7 48	7 48	8 17	7 50	123	16 41	110

* Discarded.

These results confirm those of last year, viz., that yields are decreased when all or portion of the superphosphate is not applied at seeding time. This decrease is more apparent when the major portion of the superphosphate is applied in March rather than at the time of planting.

Rate of Superphosphate Experiment.

In the previous three years that this experiment was conducted, three rates of superphosphate were used, viz., 225 lbs., 150 lbs., and 75 lbs. per acre respectively. However, this year it was decided to include extra plots planted with no superphosphate and 300 lbs. per acre respectively. In order to preserve the three-plot system of conducting the experiment it was necessary to divide it into two sections, using for each the plots treated with 150 lbs. of superphosphate per acre as controls. Thus in section 1 the rates of 300 lbs. and 225 lbs. were compared with 150 lbs. per acre, and in section 2 the rates of 75 lbs. and no superphosphate were compared with 150 lbs. per acre.

The land was of the smokebush and tussocky type of sandplain. It was ploughed with a disc implement (sundercut) during the previous June and July, cross ploughed during August and September, disc cultivated in March and springtyne cultivated before seeding.

Owing to the land not being broken down to a satisfactory tilth, the germination was uneven. Growth was particularly slow, due to some extent to the effects of the heavy June rains. Stooling also was very poor.

The plots receiving no superphosphate were an absolute failure, only a few plants producing heads. Towards the end of the season a marked difference in favour of the heavier dressing showed between the plots treated with 75 lbs. and 150 lbs. of superphosphate respectively. However, no marked advantage was apparent in the plots planted with rates heavier than 150 lbs. per acre.

The tabulated results are given below:—

WONGAN HILLS LIGHT LANDS FARM.

RATE OF SUPERPHOSPHATE EXPERIMENT NO. 1, 1929.

Variety—Nabawa. Planted on 20th May. Seed—43lbs. per acre.

Rate of Superphosphate.	Computed Yields per Acre.					Average Yield per acre, 1929.	Percentage Yields, 1929.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
225lbs. per acre ...	8 46	8 54	9 30	8 54	8 46	8 58	106
150lbs. per acre ...	8 32	8 17	8 39	8 25	8 17	8 26	100
300lbs. per acre ...	9 1	9 8	9 38	9 23	9 1	9 14	109

WONGAN HILLS LIGHT LANDS FARM.

RATE OF SUPERPHOSPHATE EXPERIMENT NO. 2, 1929.

Variety—Nabawa. Planted on 20th May. Seed—43lbs. per acre.

Rate of Superphosphate.	Computed Yields per Acre.					Average Yields per acre, 1929.	Percentage Yields, 1929.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
75lbs. per acre ...	5 21	5 43	5 58	5 58	6 19	5 52	67
150lbs. per acre (Control)	8 39	8 54	8 39	8 39	8 46	8 43	100
No Superphosphate	...	...	...	...	...	...	...

These results again show that on this class of soil applications of superphosphate considerably in excess of 75 lbs. per acre can be applied with advantage.

The additional results, although for one year only and therefore not conclusive, indicates that it is not profitable to apply superphosphate in considerable excess of 150 lbs. per acre.

Mixed Fertiliser Experiment.

The object of this experiment is to determine whether any advantage is derived by supplementing the dressing of superphosphate with a potassic manure for growing a wheat crop on light land.

Three fertilisers were used and were applied as follow:—

Plot 1.—150 lbs. Superphosphate + 56 lbs. Muriate of Potash per acre.

Plot 2.—150 lbs. Superphosphate per acre (Control).

Plot 3.—150 lbs, Superphosphate + 140 lbs. Kainite per acre.

This section of plots, each ⅛ of an acre, was repeated five times. The quantity of potash stated as K_2O is the same in 56 lbs. of the Muriate as in 140 lbs. of the Kainite.

The land was a tussock-type of sandplain which was ploughed with a Sundercut in June and cross ploughed with the same implement during August and September. It was disced lightly in March and springtyne cultivated prior to planting.

The potassic fertilisers were applied to the respective plots about three weeks before seeding. This course is considered advisable owing to the risk of injuring the young plants incurred by applying a fertiliser of this type at seeding time.

At no time during the growing period could any difference between the different plots be noticed.

The results obtained this year, together with the average results of the past three years, are as under:—

WONGAN HILLS LIGHT LANDS FARM.

MIXED FERTILISER EXPERIMENT, 1929.

Variety—Nabawa. Planted on 18th May. Seed—43lbs. per acre. Superphosphate (22%)—150lbs. per acre.

Fertiliser applied per acre.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yields per acre 1929.		Percentage Yields 1929.	Average Yields per acre, 1927-29.		Percentage Yields, 1928-29.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
Superphosphate 150lbs. ... Muriate of Potash 56lbs.... ...	9	8	9	30	8	54	8	46	8	32	8	58	101	14	59	99
Superphosphate 150lbs. (control)	8	54	8	46	9	16	8	54	8	39	8	54	100	15	7	100
Superphosphate 150lbs. ... Kainite 140lbs.	9	16	9	1	9	16	9	23	8	46	9	8	103	15	7	100

The results of this year, and also the average results for the past three years, show that the yields are not increased by applying a potassic fertiliser to this class of soil.

Nitrogen Experiment.

The objects of this experiment are—

(a) To determine whether increased yields are obtained when heavy dressings of sulphate of ammonia are applied to the wheat crop in addition to an application of superphosphate; and

(b) To ascertain whether it is advantageous to apply only part of this nitrogenous fertiliser at seeding time and part during the month of August (spring).

For the purposes of the experiment, two rates of sulphate of ammonia were applied, viz., 1 cwt. and 2 cwts. respectively.

Superphosphate was applied to all plots at the rate of 120 lbs. per acre, and those plots to which superphosphate only was applied were treated as controls. Comparisons were made between these control plots and those plots receiving 1 cwt. and 2 cwts. of sulphate of ammonia per acre respectively. With each of these dressings the whole of the fertiliser was applied at the one time, viz. at seeding, in the one instance, and also, in separate plots, the application of half of the sulphate was delayed until the month of August.

That portion of the experiment dealing with the application of 1 cwt. of sulphate of ammonia was repeated six times, whilst that portion dealing with the 2 cwt. of sulphate per acre was repeated four times.

This experiment was conducted both on fallowed and non-fallowed land.

The fallowed land was of the smokebush type of light land under crop for the first time. It was ploughed with a disc implement during June and July of 1928 and cross ploughed with the same implement (sundercut) during September, and again in March. The plots were planted on the 21st of May.

Germination was fair on both the fallow and non-fallow sections. From July onwards the plots treated with the sulphate of ammonia appeared more robust. A very marked difference was also apparent between the effects of the various dressings of the nitrogenous fertiliser. As the season advanced this difference became more apparent, the plots being denser and taller according to the quantity of sulphate of ammonia used. The additional dressings, however, at the end of August made no visible difference. In the fallow section the control plots matured 7 to 8 days later than the remainder.

The land on which the non-fallow section was planted was under crop in 1927, and since then had been grazed almost continuously. The virgin vegetation comprised tussocks and low scrub. This land was more of a clayey nature than that on which the fallow plots were situated. It was ploughed with a disc implement (sundercut) to a depth of about 3 inches two days before seeding, and was then springtyne cultivated immediately prior to planting, which took place on 3rd June.

Germination was fairly good, and from July onwards those plots treated with sulphate of ammonia showed to advantage. The difference between the various applications of sulphate of ammonia was also marked, especially as the season advanced. No improvement was noticed by the addition of the extra fertiliser in August.

In this section the control plots matured six to seven days later than the remainder.

The tabulated results of the experiment are given hereunder:—

WONGAN HILLS LIGHT LANDS FARM.

NITROGEN EXPERIMENT, 1929.

Fallow.

Variety—Nabawa. Planted on 21st May. Superphosphate (22%)—120lbs. per acre. Seed—43lbs. per acre.

Treatment.	Computed Yields per Acre.												Average Yields per acre, 1929.		Percentage Yields, 1929.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Sec. 6.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
½ cwt. Ammonium Sulphate at Seeding ½ cwt. Ammonium Sulphate in August	7	33	8	46	8	3	8	17	7	48	8	46	8	12	135
No Ammonium Sulphate (Control)	5	21	5	36	6	34	6	5	6	5	6	49	6	5	100
1 cwt. Ammonium Sulphate at Seeding	11	42	11	42	11	56	10	58	10	29	9	59	11	4	182
1 cwt. Ammonium Sulphate at Seeding 1 cwt. Ammonium Sulphate in August	11	12	11	12	...		10	29	11	12	...		11	1	167
No Ammonium Sulphate (Control)	6	19	5	50	...		7	19	6	49	...		6	34	100
2 cwts. Ammonium Sulphate at Seeding	13	24	12	25	...		11	27	11	27	...		12	11	184

WONGAN HILLS LIGHT LANDS FARM.

NITROGEN EXPERIMENT, 1929.

Non-Fallow.

Variety—Gluyas Early. Planted on 3rd June. Superphosphate (22%)—120lbs. per acre. Seed—44lbs. per acre.

Treatment.	Computed Yields per Acre.						Average Yields per acre, 1·29.	Per-centage Yields, 1929.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Sec. 6.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
½ cwt. Ammonium Sulphate at Seeding ½ cwt. in August ...	12 40	11 12	11 27	13 38	11 42	11 42	12 3	123
No Ammonium Sulphate (Control)	10 29	9 45	9 45	11 27	9 1	8 17	9 48	100
1 cwt. Ammonium Sulphate at Seeding	12 55	12 11	10 58	14 37	11 27	12 40	12 28	127
1 cwt. Ammonium Sulphate at Seeding 1 cwt. in August ...	11 56	12 25	...	13 9	13 24	...	12 43	136
No Ammonium Sulphate (Control)	10 14	9 30	...	9 45	8 3	...	9 23	100
2 cwt. Ammonium Sulphate at Seeding	15 7	14 22	...	16 19	12 40	...	14 37	156

As this experiment has been conducted for one year only, no definite conclusions can be derived. The indications, however, are that a very substantial increase is obtained when a large quantity of nitrogenous fertiliser is applied to the wheat crop on this class of soil (sandplain).

Seasonal Planting Experiment.

The objects of the experiment are:—

1. To ascertain the most suitable month to plant the Late, Mid-season, and Early maturing varieties of wheat.
2. To determine the most prolific of each of the above types.

To meet the requirements of this experiment three sections were needed, viz.:—

(a) Section 1, planted in April, representing Early planting.

(b) Section 2, planted in May, representing Midseason planting.

(c) Section 3, planted in June, representing Late planting.

Each section planted in its respective month was repeated five times, all plots being eventually harvested for grain.

The land on which this experiment was conducted was ploughed at the end of June, 1928, disc-cultivated at the end of August and at the end of March, and lightly springtyne-cultivated before seeding.

April Planting.—As the seed in this section was sown when the soil was in a dry condition, it did not germinate until the seasonal rains commenced a fortnight later. Germination was good, and early growth even. As the season advanced the two early varieties, as would be expected, made quicker growth than the other varieties, which, however, were healthy and

vigorous. From August onward the late maturing variety Yandilla King, and to a lesser extent the midseason variety Baroota Wonder Early, gradually fell behind the remainder in general appearance.

WONGAN HILLS LIGHT LANDS FARM.

SEASONAL PLANTING EXPERIMENT, 1929.

April Planting.

Seed—43lbs. per acre. Superphosphate—153lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1929.	Percentage Yield, 1929.	Percentage Yield, 1928-29.
		bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	%
Yandilla King ...	Late ...	10 43	10 36	10 51	11 27	9 38	10 39	81	99
Nabawa	Midseason ...	14 0	13 39	13 46	13 38	10 21	13 5	100	100
Baroota Wonder Early	Midseason ...	13 9	13 17	13 9	13 9	9 30	12 27	95	99
Gluyas Early ...	Early ...	13 17	13 9	13 9	12 47	11 5	12 41	95	88
Nabawa	Midseason ...	13 31	13 31	13 53	13 24	12 11	13 18	100	100
Canberra	Early ...	16 56	17 10	17 25	15 50	13 46	16 13	122	102
Nabawa	Midseason ...	13 38	13 46	13 46	13 9	11 5	13 5	100	100

May Planting.—Germination and stooling were fair, but growth was very slow. There was little difference in general appearance between the varieties, except the varieties Geeralying and Noongaar. Both these varieties were behind the remainder, particularly the Noongaar. When mature, the whole of the experiment was fairly even in height, but much shorter than usual.

WONGAN HILLS LIGHT LANDS FARM.

SEASONABLE PLANTING EXPERIMENT, 1929.

May Planting.

Seed—43lbs. per acre Superphosphate—153lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yield, 1929.	Percentage Yield, 1929.	Percentage Yields, 1928-29.
		bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	%
Yandilla King ...	Late ...	6 27	6 34	7 11	7 41	7 19	7 2	75	88
Nabawa	Midseason ...	9 23	8 39	9 30	9 38	9 59	9 26	100	100
Baroota Wonder Early	Midseason ...	7 11	7 3	7 26	7 26	7 55	7 24	78	89
Gluyas Early ...	Early ...	8 54	9 1	9 45	9 30	9 1	9 14	138	...
Nabawa	Midseason ...	6 27	7 41	6 27	6 12	6 41	6 42	100	100
Canberra	Early ...	7 3	8 10	7 33	7 41	7 3	7 30	112	108
Carrabin	Early ...	7 41	7 48	7 41	6 49	5 58	7 11	99	99
Nabawa	Midseason ...	7 33	7 48	7 19	7 19	6 12	7 14	100	100
S.H.J.	Early ...	5 58	6 12	6 19	6 34	6 27	6 16	87	85
Merredin	Early ...	5 36	6 34	6 12	6 5	5 50	6 3	87	...
Nabawa	Midseason ...	7 33	7 19	6 41	6 56	6 27	6 59	100	100
Geeralying ...	Very Early	4 59	5 21	5 6	4 15	3 46	4 41	67	...
Noongaar	Very Early	3 39	3 53	3 24	3 37	3 2	3 31	52	63
Nabawa	Midseason ...	6 27	6 56	6 27	6 27	5 50	6 25	100	100

June Planting.—In this section the germination was poor and growth very slow throughout the season. The plants were poor and spindly, practically no stooling. There was little or no difference between the varieties at any time, except the Noongaar, which was behind the remainder. The heads of all varieties were small and the straw very short.

WONGAN HILLS LIGHT LANDS FARM.

SEASONAL PLANTING EXPERIMENT, 1929.

June Planting.

Seed—43lbs. per acre. Superphosphate—153lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yields per acre, 1929.		Percentage Yields, 1929.	Percentage Yields, 1928-29.
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	%
Gluyas Early ...	Early ...	2	55	2	48	2	55	2	40	3	24	2	56	90	92
Nabawa	Midseason ...	3	17	3	10	3	24	2	55	3	32	3	16	100	100
Canberra	Early ...	3	39	3	39	3	53	3	32	4	23	3	49	117	97
Merredin	Early ...	3	32	3	24	3	39	2	55	3	53	3	29	97	...
Nabawa	Midseason ...	3	53	3	53	3	32	3	17	3	24	3	36	100	100
S.H.J.	Very Early	2	33	2	48	2	48	2	26	2	33	2	38	73	79
Geeralying ...	Very Early	2	48	3	10	2	40	2	55	3	32	3	1	92	...
Nabawa	Midseason ...	2	55	3	32	3	24	2	55	3	32	3	16	100	100
Noongaar ...	Very Early	1	50	1	35	1	42	1	35	1	57	1	44	53	80
Carrabin	Early ...	3	10	3	39	3	10	3	10	3	53	3	24	117	94
Nabawa	Midseason ...	3	17	2	55	2	33	2	40	3	10	2	55	100	100

The results of this experiment again show that early planting gives the best results on this class of soil.

Whilst the June yields are again obviously unprofitable, even the May planting this year does not approach the April planting. This is partly due to the dry spring, but, it is believed, mainly to the exceptionally heavy rains in June. The excessive wet and cold retarded the growth of all varieties which did not have the chance of making strong vigorous growth before these conditions occurred. It is evident, therefore, that it is best to sow as much as possible in April and early May in order to give the crop a chance to make good headway before these unfavourable conditions are likely to occur.

As would be expected in a season such as was experienced last year, the early maturing varieties have shown to advantage in all three plantings. In a normal season, however, when the spring rains are usually sufficient, experience has shown that it is inadvisable to plant early maturing varieties during April owing to the risk of these varieties being affected by the disease Septoria. To avoid this the late midseason varieties should be planted during that month.

Oat Variety Trial.

This experiment was identical with the trials conducted during the previous two years' seven varieties being planted, including the control variety Burt's Early.

The plots were on a smokebush and tussocky type of sandplain. The land was ploughed with a disc implement (sundercut) during the months of June and July, 1928. During August and September it was again disced, and in March it was disc cultivated. Prior to seeding the land was springtyne cultivated.

All the varieties were seriously affected by the lack of rain during the latter part of September. However, they were improved, to some extent, by the belated rains which fell during October. Of all the varieties, Mulga withstood the adverse conditions best.

The tabulated results for both hay and grain are given below:—

WONGAN HILLS LIGHT LANDS FARM.

OAT VARIETY TRIAL, 1929.

Grain Yields.

Planted on 22nd May. Seed—40lbs. per acre. Superphosphate—150lbs. per acre.

Variety.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yields per acre, 1929.		Percentage Yields, 1929.	Average Yields per acre, 1926-29.		Percentage Yields, 1926-29.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
Mulga	5	34	5	26	5	29	5	34	6	16	5	36	140	11	34	96
Burts Early ...	4	15	4	4	4	4	4	4	4	19	4	9	100	12	14	100
Ruakura ...	3	4	3	0	3	11	3	33	3	37	3	15	80	10	31	87
Algerian ...	3	11	3	4	3	23	4	19	4	43	3	36	91	14	27	123
Burts Early ...	4	15	4	5	4	15	4	19	4	8	4	12	100	11	39	100
Guyra	4	1	4	12	4	30	4	19	4	30	4	20	104	13	30	115
Burts Early ...	4	15	4	15	4	19	4	19	4	27	4	19	100	16	21	100
Lachlan... ...	4	30	4	43	6	8	6	8	5	34	5	25	126	13	21	83

WONGAN HILLS LIGHT LANDS FARM.

OAT VARIETY TRIAL, 1929.

HAY YIELDS.

Planted 22nd May. Seed—40lbs. per acre. Superphosphate (22%)—150lbs. per acre.

Variety.	Maturity.	Computed Yield per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Average Yield per acre 1929.	Percentage Yield, 1929.	Average Yield per acre 1926–29.	Percentage Yields 1926–29.
		C. Q. L.	C. Q. L.	C. Q. L.	C. Q. L.	%	C. Q. L.	%
Mulga	Early ...	5 3 14	7 0 20	7 3 24	7 0 1	149	23 1 4	116
Burts Early (Control)	Early ...	4 1 14	4 3 17	4 3 2	4 2 20	100	20 0 19	100
Raukura ...	Midseason ...	2 0 2	2 0 17	2 0 10	2 0 10	45	15 0 0	74
Algerian ...	Late... ...	3 3 4	3 2 10	3 2 24	3 2 22	76	18 2 13	89
Burts Early (Control)	Early ...	4 2 23	4 1 0	5 2 6	4 3 10	100	20 3 26	100
Guyra	Midseason ...	3 3 11	4 0 13	3 3 19	3 3 24	82	19 1 10	92
Burts Early (Control)	Early ...	4 3 9	6 1 17	6 3 4	6 0 1	100	20 0 13	100
Lachlan... ...	Midseason ...	5 1 19	5 1 26	4 3 2	5 0 25	87	20 1 7	101

These results confirm those of previous years, viz., that the early and midseason maturing varieties are the most suitable for grain and the early varieties for hay. They further demonstrate the suitability of the early maturing variety, Mulga, for both hay and grain under adverse conditions.

Rate of Seeding Experiment—Oats.

As was the case for the similar experiment with wheat, this was planted with a free and a sparse stooling variety, and the land also was prepared identically with that for the wheat experiment.

The results of both representative types are given below, together with average results for the past four years:—

WONGAN HILLS LIGHT LANDS FARM.

RATE OF SEEDING EXPERIMENT, 1929—OATS.

Variety—Algerian. Planted on 25th May. Superphosphate (22%)—150lbs. per acre.

Rate of Seeding.	Computed Yields per Acre.										Average Yields. per acre, 1929.		Percentage Yields, 1929.	Average Yields per acre, 1926-29.		Percentage Yields, 1926-29.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
45lbs. per acre ...	3	4	3	4	3	11	3	11	3	4	3	7	118	13	14	114
30lbs. per acre ...	2	29	2	29	2	29	2	22	2	29	2	28	100	11	28	100
60lbs. per acre ...	3	4	3	11	3	19	3	19	3	11	3	13	123	13	21	116

WONGAN HILLS LIGHT LANDS FARM.

RATE OF SEEDING EXPERIMENT, 1929—OATS.

Variety—Burts Early. Planted on 27th May. Superphosphate (22%)—150lbs. per acre.

Rate of Seeding.	Computed Yields per Acre.										Average Yields per acre 1929.		Percentage Yields 1929.	Average Yields per acre, 1926-29.		Percentage Yields, 1926-29.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
45lbs. seed per acre	4	1	3	26	4	39	4	15	4	1	4	8	102	14	18	100
30lbs. seed per acre	4	1	3	26	4	39	4	15	3	26	4	5	100	14	18	100
60lbs. seed per acre	4	1	4	15	4	30	4	8	3	33	4	9	102	14	25	101

These results confirm those of the three previous years, viz., that with a free stooling variety like Algerian, increased yields are obtained when the heavier rates of 40 lbs. and 60 lbs. of seed are sown. Of the two rates, however, the average results for the four years disclose that the rate of 40 lbs. per acre is the most economical.

The results with the sparse stooling variety, Burts Early, for this year and the averaged results for the three years the experiment has been carried out, show that there is practically no difference in the yields obtained from the different rates of seed.

It is surprising that with these two varieties the yields of the free stooling type were increased by the heavier rates of seed, whereas no advantage was gained when the heavy rates were sown with a sparse stooling variety. This is the reverse to what was experienced with a similar experiment carried out with wheat, and is contrary to what may have been expected. This may be due to the sparse stooling variety containing a greater number of seeds per bushel than the freer stooling one, which has larger and heavier grain.

MOISTURE AND NITRATE NITROGEN FLUCTUATIONS IN MULCHING EXPERIMENT PLOTS.

STATE EXPERIMENT FARM, MERREDIN.

L. J. H. TEAKLE, Plant Nutrition Officer,
and
G. H. BURVILL, Agricultural Adviser.

The investigations reported by Teakle (1928) were continued on a new set of plots in 1928 and 1929. As it was desired to obtain further and comparable data concerning the effects of cultivation on the soil, very similar methods were used. Also, the soils were of a similar type, locally known as samlon gum and gimlet soils. These soils are described by Teakle and Burvill (1930). The plots were situated west of the farm buildings, being about half a mile from the plots described in the previous discussion. Sampling and laboratory work were carried out as described by Teakle and Burvill (1930). The plots were sampled at each end only, the sites being selected at a distance of three chains from each headland.

Unfortunately the work had to be discontinued after the April sampling owing to the absence of the senior author. However, plot yields were obtained from the Superintendent of Wheat Farms so that the chemical data may be compared with the harvest returns.

In the Mulching Experiment fifteen plots were fallowed in June, 1928, and treated as follows:—

Treatment 1.—Five plots were cultivated during spring and thereafter following every fall of 25 points or more of rain.

Treatment 2.—Five plots were cultivated during spring and before seeding—Control.

Treatment 3.—Five plots were cultivated before seeding only—neglected fallow.

On account of the dry summer in 1928, the plots under treatments 1 and 2 had received the same cultivations by the time of the November sampling, so were treated together. The treatments were considered separately at subsequent samplings.

The Crop Yields.—It seems opportune to discuss the yields obtained in 1928 from the plots dealt with in the previous article by Teakle (1928) as well as those obtained in 1929. The yields in 1928 are reported in Table 1 and those in 1929 in Table 2.

TABLE 1.

Yield of wheat from plots of the Mulching Experiment, Experiment Farm, Merredin, 1928. (Journal of Agriculture (West Aus.), 6: 319, 1929).

Treatments.	Yields.			
	bus.	lbs.	Percentage, 1928.	Percentage 1915-1928.
Treatment 1.—Fallow cultivated during Spring and thereafter following every fall or 25 points or more of rain	17	52	111	103
Treatment 2.—Control. Fallow cultivated during Spring and before Seeding	16	8	100	100
Treatment 3.—Neglected fallow. Fallow cultivated before seeding only	14	40	91	95

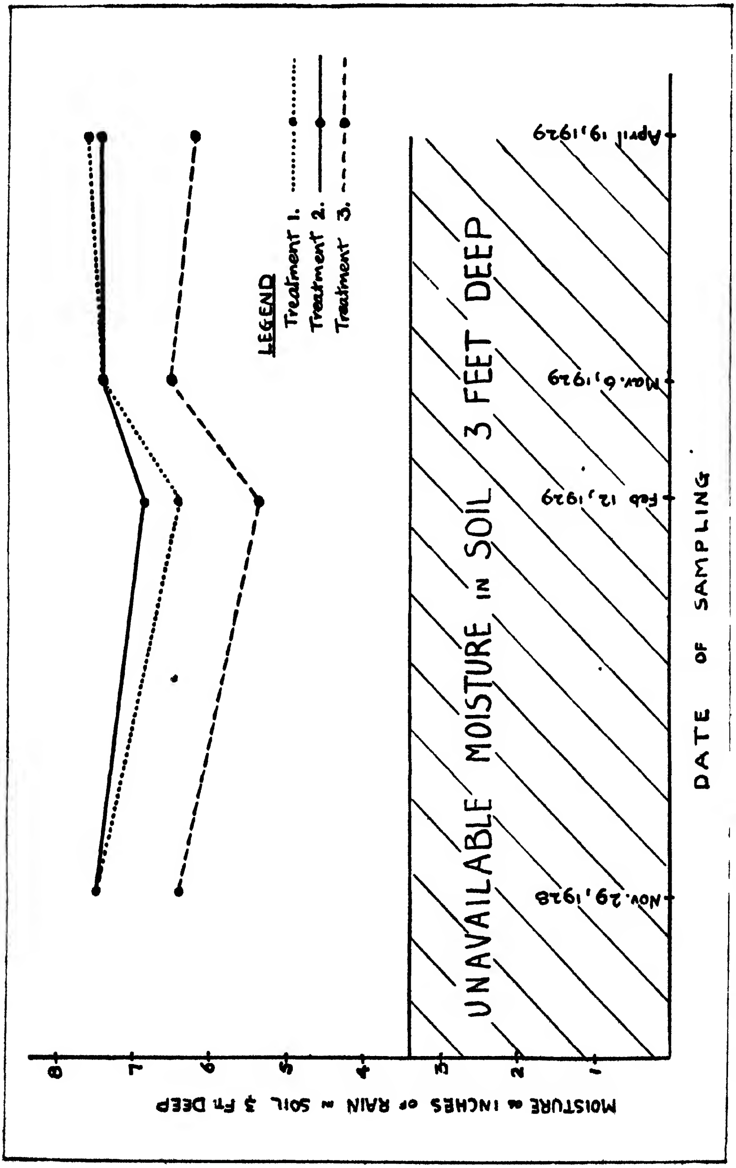


Fig. 1.—Moisture, in terms of an equivalent of rain, in the soil to a depth of 3 feet from plots of the Mulching Experiment, Experiment Farm, Merredin. The amount of moisture regarded as not economically available is shown by the hatched portion of the figure.

TABLE 2.

Yield of wheat from plots of the Mulching Experiment, Experiment Farm, Merredin, 1929. (Figures kindly supplied by the Superintendent of Wheat Farms).

Treatment.	Yields.			
	bus.	lbs.	Percentage, 1929.	Percentage, 1915-1929.
Treatment 1.—Fallow cultivated during Spring and thereafter following every fall of 25 points or more of rain	22	9	98	103
Treatment 2.—Control. Fallow cultivated during Spring and before Seeding	22	26	100	100
Treatment 3.—Neglected fallow. Fallow cultivated before Seeding only	20	47	92	95

The Results of Soil Analyses.—The results of the analyses for the 1928 season are reported in a previous number of this Journal (Vol. 6: 444-448), to which the reader is referred, as it is considered that the results of the two years' work are in sufficient agreement to enable the authors to discuss in detail the analyses made in 1929 only. A repetition of the figures already published seems unwarranted.

The analytical results for 1929 are indicated in Tables 3 and 4, and are represented graphically in Figs. 1 and 2. The moistures are expressed both as per cent. water on the dry soil basis and as the equivalent of rainfall. The amount of water probably available for crop growth is calculated on the assumption that an acre foot of soil weighs 3,750,000 lbs. and that 4 per cent. moisture in the first foot and 8 per cent. moisture in the second and third feet of soil are not economically available for crop growth.

TABLE 3.

The moisture content of plots of the Mulching Experiment, Experiment Farm, Merredin. 1928–29.

Date of Sampling.	Depth.	*Treatment* 1—Fallow cultivated during Spring and thereafter following every fall of 25 points or over of rain.		*Treatment* 2—Control Fallow cultivated during Spring and before Seeding.		*Treatment* 3.—Neglected fallow. Fallow cultivated before Seeding only.	
		Moisture.		Moisture.		Moisture.	
	ins.	%	ins. of rain.	%	ins. of rain.	%	ins. of rain.
Nov. 29th, 1928	0–12	12·0	2·02	12·0	2·02	8·6	1·44
	12–24	16·1	2·70	16·1	2·70	14·7	2·47
Total, 2 ft. ...	...	...	4·72	...	4·72	...	3·91
Feb. 12th, 1929	0–12	8·9	1·50	9·6	1·61	6·8	1·14
	12–24	15·1	2·54	15·2	2·55	12·0	2·02
	24–36	13·9	2·33	16·0	2·69	13·0	2·18
Total, 3ft. ...	...	...	6·37	...	6·85	...	5·34
Mar. 5–6th, 1929	0–12	13·9	2·33	14·1	2·37	12·3	2·06
	12–24	15·6	2·62	15·4	2·59	13·6	2·28
	24–36	14·4	2·42	14·4	2·42	12·9	2·16
Total, 3 ft. ...	...	...	7·37	...	7·38	...	6·50
Apl. 19th, 1929	0–12	13·6	2·28	13·1	2·20	11·6	1·95
	12–24	15·8	2·65	15·3	2·57	12·8	2·15
	24–36	15·6	2·62	15·6	2·62	12·2	2·05
Total, 3ft. ...	...	...	7·55	...	7·39	...	6·15
Available April 19th, 1929, to a depth of 3 ft.	...	...	4·19	...	4·03	...	2·79

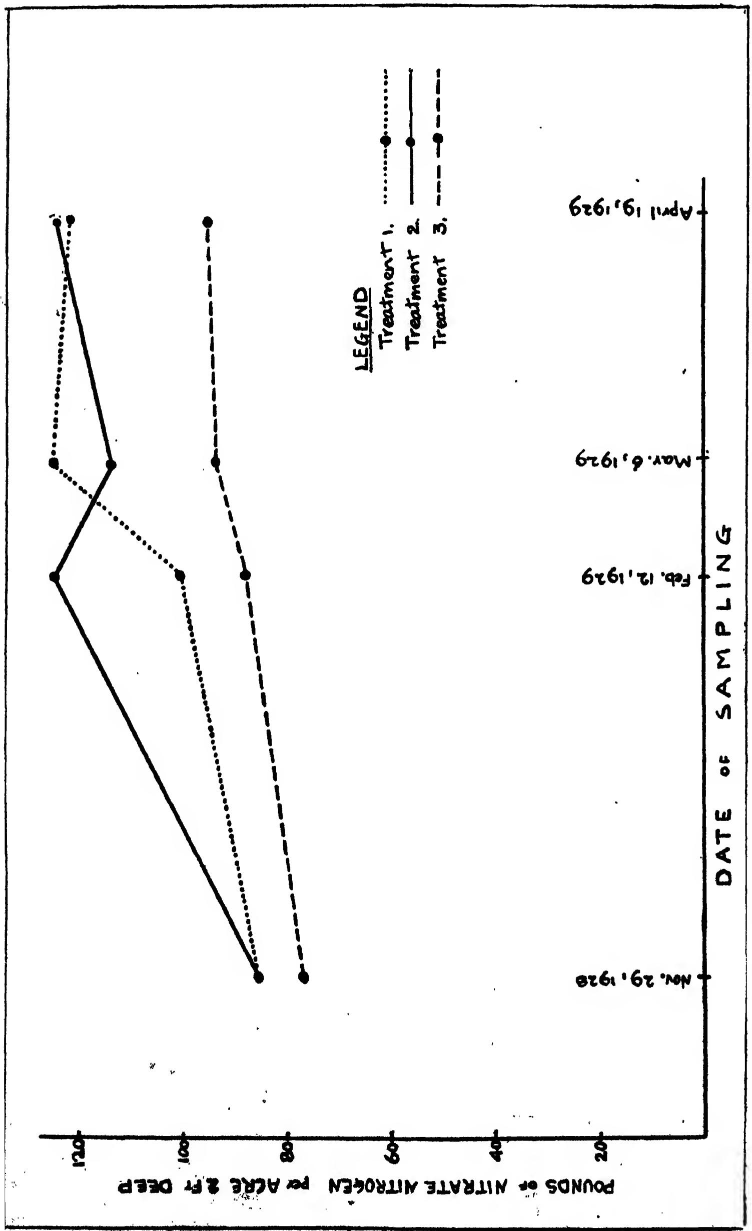


Fig. 2.—Pounds of nitrate nitrogen in the soil to a depth of two feet from plots of the Mulching Experiment, Experiment Farm, Merredin.

TABLE 4.

Nitrate nitrogen contents of plots of the Mulching Experiment, Experiment Farm, Merredin, 1928–29.

Date of Sampling.	Depths.	*Treatment* 1—Fallow cultivated during spring and thereafter following every fall of 25 points or over of rain.		*Treatment* 2—Control. Fallow cultivated during Spring and before Seeding.		*Treatment* 3—Neglected fallow. Fallow cultivated before Seeding only.	
		Nitrate	Nitrogen.	Nitrate	Nitrogen.	Nitrate	Nitrogen.
	ins.	ppm.	lbs. per acre foot.	ppm.	lbs. per acre foot.	ppm.	lbs. per acre foot.
Nov. 29th, 1928	0–12	11·8	44·2	11·8	44·2	8·5	31·9
	12–24	42·0	42·0	11·2	42·0	12·2	45·7
Feb. 12th, 1929	0·12	15·4	57·7	19·4	72·7	12·5	46·8
	12–24	11·6	43·5	14·0	52·5	11·1	41·7
	24–36	9·9	37·2	13·8	51·7	22·2	83·3
Mar. 5–6th, 1929	0–12	18·8	70·5	17·9	67·2	13·8	51·8
	12–24	15·0	56·2	12·5	46·8	11·4	42·7
	24–36	10·4	30·0	13·2	49·5	27·0	101·2
Apl. 19th, 1929	0–12	21·0	78·7	18·8	70·5	16·0	60·0
	12–24	11·7	43·8	14·6	54·8	9·6	36·0
	24–36	13·6	51·0	38·4	144·0	6·8	25·5
			lbs. per acre		lbs. per acre		lbs. per acre
Total Nitrate Nitrogen to a depth of 2 feet, April 19th, 1929	...	...	122·5	...	125·3	...	96·0

DISCUSSION OF RESULTS.

In the experiment of 1928 at the April sampling the well cultivated plots and the control plots were superior to the neglected fallow plots with respect to moisture and nitrate nitrogen—particularly the latter. There was no significant difference between the control and the well cultivated plots. At the end of the season (October 26-27, 1928, the differences between the treatments were very small—probably too small account for the differences in yield. However, any chemical differences are in favour of the treatments giving the highest yields.

In 1929 the yields of the plots under the several treatments showed only slight differences. The yields from the well cultivated fallow (Treatment 1) and the control were practically identical, while that from the neglected fallow was 8 per cent. below the control. This latter difference is probably significant. While this order conforms with the figures obtained for moisture and nitrate nitrogen at the April sampling, the differences are of insufficient magnitude to allow the formulation of definite conclusions. It seems probable, however, that the spring and autumn cultivations resulted in the soil being in a slightly improved physical and chemical condition for the growth of the crop. The accumulation of nitrate nitrogen probably gives an accurate picture of the soil fertility, that complex condition which governs the crop producing power of a soil. The improved tilth, absence of weeds, and the higher moisture contents of the soil during the summer months afford more favourable conditions for the growth of micro-örganisms and the enrichment of the soil solution with respect to the mineral requirements of the crop. The extent of this enrichment is reflected by the activities of the nitrifying (nitrate producing) organisms and the consequent accumulation of nitrate nitrogen.

SUMMARY AND CONCLUSIONS.

The Mulching Experiment plots at the Experiment Farm, Merredin, were sampled between November, 1928, and April, 1929, and the soils examined for moisture and nitrate nitrogen.

The plots received the following cultural treatments:—

Treatment 1.—Fallow cultivated during spring and thereafter following every fall of 25 points or more of rain.

Treatment 2.—Control. Fallow cultivated during spring and before seeding.

Treatment 3.—Neglected fallow. Fallow cultivated before seeding only.

The soils were a red brown clay loam typical of salmon gum and gimlet forests of the wheat belt.

The following conclusions are suggested:—

1. Summer cultivation in the absence of general and regular summer rains leads to no apparent improvement of the plots with respect to moisture and nitrate nitrogen.

2. Plots cultivated after ploughing and before seeding (control) are slightly superior to those which are left in the rough after ploughing and are cultivated before seeding only.

3. The chemical differences, although slight, are reflected by the yields of grain.

4. The differences in yield are probably not due directly to the moisture and nitrate nitrogen content of the soils of the respective plots, but to a general improvement in fertility resulting from the cultivation.

5. Improved tilth and moisture conditions during the summer months enable soil microörganisms to enrich the soil solution with respect to materials such as nitrate, sulphate, lime, potash, etc., which are required by the crop, and make the soil a more suitable medium for the growth of the crop.

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STACK SILAGE.

G. K. BARON-HAY,
Superintendent of Dairying.

The unusually dry summer throughout the Dairy Belt has caused attention to be turned to reliable means of conserving or growing suitable succulent fodder for these comparatively dry months.

Farmers have, among other methods, made inquiries as to economical means of producing silage on dairy farms in the South-West.

Although overhead tub silos are recommended where they can be cheaply constructed, the writer does not believe this expense justified on a dairy farm in the initial stages of development.

Pit or trench silos, as described in the "Journal of Agriculture," September, 1924, are recommended where overhead silos cannot be constructed. The success of pit silage, however, depends on a site being available where water-logging would not be caused by the winter rains.

The loss of material through mould in an overhead or a trench silo should not exceed 7 per cent., if properly constructed.

On farms where it is considered desirable to conserve fodder as silage, and neither of the above methods is applicable, then resort must be had to the stack.

Method.—The building of stack silos should only be contemplated in order to preserve fodder, which would otherwise be difficult to handle economically.

The early top-dressing of pastures is now almost universally practised throughout the Dairy Belt, and has resulted in a plethora of green fodder in the months of September, October, and November. It is probable that this flush season will be considerably increased through the judicious use of nitrogenous fertilisers for top-dressing, and experiments will be carried out in this connection during the coming season.

Once the growth of a pasture has become rank, then the feeding value is decreasing, and the fodder should be immediately consumed by stock, or treated in some other way, so that a fresh, young and more nutritious growth may take place.

Should the weather permit, which generally will not be the case before late in spring, meadow hay is recommended as the most economical method of conserving this nutritious fodder, as with well made hay there is little if any loss in nutriment.

It already has been found necessary in certain districts, however, to cut this rank growth early in spring, while rainy conditions still prevail, and it is in such cases that the stack silo is recommended as a method of saving a large proportion of this fodder when in its most nutritious state. This silage, too, is a further provision for ensuring a supply of green material for food in the summer months.

A number of silage stacks have been examined by Mr. J. T. Armstrong and Mr. M. Cullity, Field Officers, stationed in the Denmark and Manjimup areas respectively, and the causes for success or failure noted.

Stack Silo built by Messrs. Bayley Bros., Denmark. Note settling of material. Earth and logs placed on top to cause even and continuous pressure. It is preferable to open stacks at the top, taking a shallow layer of silage each day.

The following points are necessary to ensure success with the stack silo:—

1. The material to be ensiled should be quite green and succulent. A number of silos were noted in which the proportion of waste was over 30 per cent., due to the material being too dry. This admits an excessive amount of air, causing moulds to develop and allows too much fermentation. Such material should be made into meadow hay.

2. A considerable percentage of clovers is desirable, the best quality silage being noted in those stacks where the material was almost entirely subterranean clover. Crops, such as oats, wheat, maize, and sorghums are not recommended for stack silage, owing to the difficulty of pressing sufficiently to exclude air.

3. The stack should be square, and should contain not less than 20 tons of silage. The square stack has less area exposed in proportion to volume than the oblong one. The minimum base for a stack should be 12 feet by 12 feet.

4. The stack may be completed immediately, but it will usually be found preferable to spread the building over several days. This is no detriment and allows a certain amount of sinking to take place. It should be made as high as possible, 12 feet being a convenient height before settling takes place. Care must be used to ensure the stack is on a level base and that building has been even, so as to allow for regular sinking, otherwise the stack will slip, open, and the material be ruined.

Cutting, carting and stacking may be continued irrespective of the weather, whether rainy or fine. In order to prevent slipping, posts may be placed at each corner, more than four being undesirable as likely to prevent even settlement.

5. As each day's portion of the stack is built, the sides should be scraped free from loose material, which otherwise would be wasted.

6. The stack should be finished off flat at the top, so that posts or planks may be placed thereon, and sacks of dirt or loose earth thrown on to assist in excluding the air by pressure—9 inches of earth has been found quite sufficient, or a layer of sugar bags of earth placed on posts.

Subsidence is considerable, a 12ft. stack commonly sinking to 5 or 6 feet within six weeks.

7. An examination of a number of stacks has shown that, where the average depth to which air has intruded on three sides may be not more than 8 inches, on the side of the prevailing winds during the hot months the material has been destroyed to a depth of 18 inches, through infiltration of air and the drying effect of the wind. It is recommended that this side be protected either by sheet iron or by bushes built against the stack, so as to break the force of the wind.

Messrs. Bayley Bros., of Denmark, have built such stack silos each year for three years, and in future intend to carry out this practice as the general farm routine. These farmers have found that by cutting a field early in spring for silage, the same area, if fertilised with a nitrogenous fertiliser, may be cut some 6 to 7 weeks later for meadow hay. Under these circumstances, stack silage is most profitable.

The following analyses of silage made from pasture, mostly subterranean clover, show that the stack method can supply quite good silage:—

Type of Silo.	Moisture.	Ash.	Protein.	Starchy Matter.	Fibre.	Fat.	Unit Value.
Overhead Tub—3 silos ...	69·00	3·49	4·51	12·48	8·98	1·54	20·45
Pit—2 silos	76·0	3·15	4·25	8·90	6·76	0·94	15·26*
Stack—6 silos	70·9	3·00	4·05	12·22	8·90	0·84	18·16
Green Subterranean Clover	72·0	3·23	5·88	13·24	4·36	1·29	22·02

* Cut too young and succulent.

OAT VARIETY TRIALS.

BODDINGTON AND DARDANUP.

G. GAUNTLETT,
Agricultural Adviser, Dairy Branch.

In conjunction with the other experiments, several Oat Variety Trials were conducted by the Dairy Branch.

The trial at Boddington was planted on a light loam, which was gravelly in places. In its virgin state, the soil grew chiefly wandoo and a little red gum. Complete figures are not available for the rainfall, but it was well below the average of 29 inches.

The experiments show that profitable crops of oats can be grown in this district, and that the later varieties, "Algerian" and "Lachlan," are the best varieties for grain, with "Guyra" as a good dual variety.

The following are the details:—

Planted 28th May. Rate of Seeding—60lbs. per acre. Rate of Super.—1 cwt. per acre.

YIELDS.

Variety.	Hay.				Percentage.	Grain.		Percentage.
	tns.	cwt.	qrs.	lbs.		bus.	lbs.	
Algerian	1	8	2	13	100	23	19	100
Burts Early	–	18	2	25	62·9	20	32	88·6
Mulga	1	5	1	9	88·5	20	1	85·3
Guyra	1	12	3	12	114·8	23	13	99·4
Lachlan	1	5	3	26	90·8	26	38	114·8

Oat Variety Trial—Dardanup.—As at Boddington, the rainfall at Dardanup was considerably below the average, and consequently the yields obtained from the plots are not a true reflex of the district. A yield of 3 tons hay per acre is no uncommon thing for Dardanup. The crop, while being very even, did not stool much.

Besides being an Oat Variety Trial, this experiment supplies useful information in the rotation of crops on well drained land. Three crops may be obtained from this type of land during the year. Maize planted in October-November, and cutting finished by the end of February. The land may then be ploughed, and a catch crop of rape planted in March and fed off. The land can then be further ploughed in June and sown with oats in early August. The latter crop is then cut for hay in middle December.

The following are the details of the experiment:—

Soil—red loam, well drained.
Planted early August.
Rate of Seeding—60lbs. per acre.
Rate of Super—1 cwt. per acre.

RAINFALL, 1929.

——	Jan.	Feb.	Mar.	Apl.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
...	3	59	115	209	1,055	940	372	387	164	109	219	27	3,419
Average	60	66	117	174	555	769	768	595	440	315	110	61	4,081

YIELDS.

Variety.	Hay—1 acre.				Percentage.
	tons.	cwts.	qrs.	lbs.	
Pedigreed Algerian	1	12	1	18	138
Burts Early	1	3	3	2	102
Guyra	1	7	0	1	115
Lachlan	1	2	2	1	96
Mulga	1	0	2	3	88
Farmer's Algerian	1	3	1	18	100

MARKET REPORT.

Messrs. H. J. Wigmore and Co., Ltd., of Wellington Street, Perth, have supplied us with the following information regarding chaff available at the Metropolitan chaff and grain auction sales held in Perth for the period December to February (inclusive). In all cases the prices quoted are for f.a.q. to prime wheaten chaff, packed in new bags.

	Quantity.	Maximum.			Minimum.		
		£	s.	d.	£	s.	d.
December	950	5	5	0	5	0	0
January	1,050	5	10	0	5	0	0
February	1,000	5	5	0	5	0	0

At time of going to press with the last Report, the market stood at £5, and if the above quantities are compared with those of the last issue, it will be seen that considerably less chaff was available during the last three months. The demand, however, has been poor, and that, together with the present financial depression, has prevented the market from appreciating to any extent, at time of writing, the market being steady at £5 5s.

Stocks of hay held in the country are not large, and with a demand from farmers for fodder for seeding, fallowing, etc., in the near future prices should improve somewhat.

Oaten Chaff.—Abnormally heavy supplies were available in December and January, nearly half the quantity mentioned being oaten. Towards the end of February consignments dwindled somewhat and with a better demand, the market now stands as follows:—

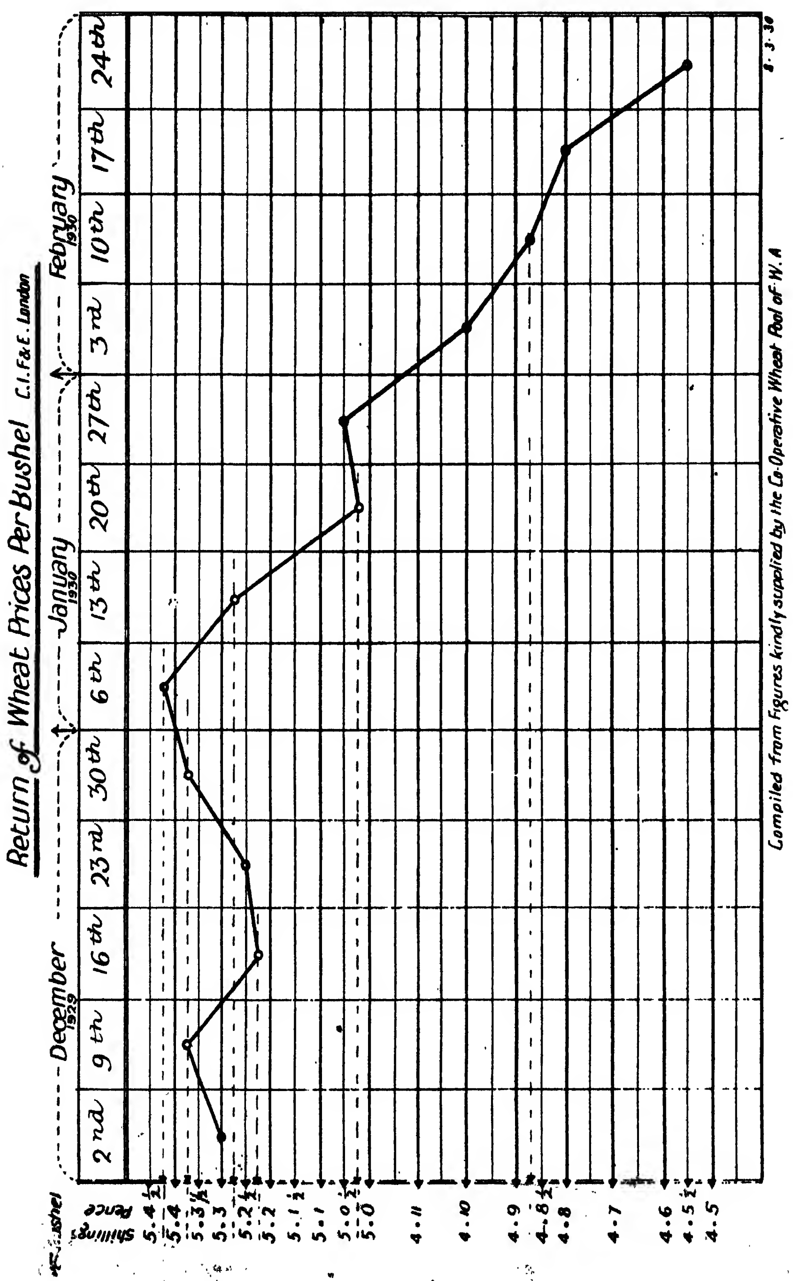
Prime Green ..	£4 12 6 to £4 15 0	per ton.
F.a.q.	£4 5 0 to £4 7 6	per ton.
Mediums ..	£4 0 0 to £4 2 6	per ton.

This market should improve in the near future.

Oats.—During the months enumerated above the market has been glutted, anything but prime quality suitable for seed being difficult to dispose of. The following is an indication of present market values:—

Good clean heavy feeds, 2/2 to 2/4 per bushel.
Mediums, 1/10 to 2/- per bushel.
Light and inferior, from 1/6 per bushel.

Wheat.—This market, in sympathy with the Overseas values, has fluctuated considerably. However, during the last few days there has been a firm enquiry for f.a.q. at from 4/10 to 5/- per bushel. Other qualities at lower prices according to sample.


Return of Wheat Prices Per Bushel C.I.F.&E. London
December 1929
January 1930
February 1930
2nd
9th
16th
23rd
30th
6th
13th
20th
27th
3rd
10th
17th
24th
Per Bushel
Shillings Pence
5.4½
5.4
5.3¾
5.3
5.2¼
5.2
5.1½
5.1
5.0½
5.0
4.11
4.10
4.9
4.8½
4.8
4.7
4.6
4.5½
4.5
Compiled from Figures kindly supplied by the Co-Operative Wheat Pool of W.A
8.3.30

LIVE STOCK AND MEAT.

For the information of readers of the "Journal," the following par-ulars have been supplied by Messrs. Elder Smith & Co., Limited, Perth:—

OMPARATIVE YARDINGS OF STOCK SOLD, METROPOLITAN MARKETS, DURING THE MONTHS OF DECEMBER, 1929, AND JANUARY AND FEBRUARY, 1930.

—	December.				January.				February.			
	4th.	11th.	18th.	31st.	8th.	15th.	22nd.	29th.	5th.	12th.	19th.	26th.
ep	10,835	13,634	15,492	10.280	12,404	13,575	11,921	13,766	13,575	13,031	10,559	8,612
le	1,051	961	1,064	633	777	745	680	665	794	655	775	749
... ...	642	832	1,263	370	859	852	922	923	956	783	811	848

OMPARATIVE VALUES PER POUND OF STOCK SOLD, METROPOLITAN MARKETS, DURING MONTHS OF DECEMBER, 1929, AND JANUARY AND FEBRUARY, 1930.

—	December.				January.				February.			
	4th.	11th.	18th.	31st.	8th.	15th.	22nd.	29th.	5th.	12th.	19th.	26th.
tton ...	5½	5½	5½	7½	7½	7	6½	6	6	5½	5¼	6
ef	7¼	6¾	6	6½	6	6¼	6¾	7¼	7¼	7	7¼	7
rk	12	12	12	11	11½	11¼	11¼	11¼	11	10½	10	9
con	9	9	9	9	9¼	9¼	9	9	9	9	9	9

PRODUCERS' MARKETS, LTD.

Quarterly Report for Three Months ending 10*th February,* 1930.

Fruit.—Supplies of all varieties in season has been forward in volume. arly in December Geraldton tomatoes eased, the local coming forward king their place and sold to a good demand for prime. Good supplies ntinued up to February. For the past two months prices have been very settled. Prime lemons have held their price throughout. Large rough rts were hard to quit. Towards the end of February fair consignments green skins were forward, and sold to a fair demand. Early in December few navels were forward and sold to a good demand, realising up to s. double case; at the time late Valencias were in demand and have ntinued throughout, falling off slightly in volume to the end of the arter; prime coloured lines realised up to 21s. 6d. three-quarter bushel. arge rough lines from 5s. up, a good quantity of late Valencias with very een skins have been marketed and sold to a poor demand. In December a ir supply of cherries were forward and all prime sold to a fairly good de-and. These ceased about the end of December. In the early part there as a fair supply of cool store apples forward, which ceased about the cond week in January. Prime stuff realised good prices, Granny Smith alising the best of all varieties. New season apples commenced the third eek in December and have since increased in volume. Principal varieties

offering are Jonathans, Cleopatras and Dunns. Fair prices were obtained between the middle of January up to the second week in February, when prices slumped owing to a good quantity of culls and mis-shaped fruit being placed on the market. Since, prices have righted themselves, with prime Jonathans selling up to 12s. 6d., Dunns to 10s. 6d., and Cleopatras to 8s. 6d. Heavy supplies of stone fruit was forward throughout December. Prime apricots brought good prices and small fruit hard to quit. Prime peaches were always in demand owing to so much inferior fruit on the market. Peaches have been supplied heavily throughout, and towards the end heavy supplies of large hard green fruit have been marketed, meeting only a medium demand, and small over-ripe cheap. Plums also have been very heavily supplied. Wickson, Kelsey, Satsumas and English Black were most in demand. Large prunes sold well, others small, including varieties above, were hard to quit at satisfactory rates. In the latter varieties coming forward, Black Diamonds, Presidents, and Delaware, all these realised high prices, up to 21s. three-quarter bushel.

Nectarines were also well supplied, and the majority were small; prime lines always met a good demand, and towards the end of the quarter selling from 18s. to 21s. for prime three-quarter bushel. Grapes came in with early Chaslers and Madalines. We sold to fair demand around the middle of January. Muscats came forward early, realising good prices up to 20s. 9d. open cases; since they have increased in volume, prices being very irregular owing to weather conditions and heavy supplies forward.

Passion fruit were dear in the early part and at midway were met with heavy supplies, selling from 3s. 6d. to 7s. 6d. for three-quarter bushel; same has since eased in volume and are now selling to better average price around 10s. A fair supply of figs forward this year and selling to good demand for prime. In December a fair supply of loquats were forward. The majority of these were also small; prime sorts realised well. Supplies of Cape gooseberries have been light throughout; during the last month the market has been bare. Prime large berries met a good demand. Through December a good quantity of cherries were marketed with all prime lines selling to a good demand, realising good prices. A good quantity came forward very wet and appeared to be packed much too ripe. These realising only a fair price, supplies ceased about the first week in January. A fair supply of strawberries forward to a fair demand, realising fair average prices throughout. There has been a full glut of Bartlett pears forward which in the early part of the season were hard to quit satisfactorily. During the last two weeks they improved, selling to a good demand for prime, realising from 5s. to 12s. 6d.

Vegetables.—The supply of vegetables has been exceptional during the quarter. Metropolitan potatoes have been heavily supplied to a very weak demand and values have been at glut level for most of the period under review. Growers generally have experienced a very bad season with their potato crop. The sudden collapse of the market in the Eastern States early in December caused merchants to cease exporting and this had a weakening effect on local values, for the market has not yet recovered. Country potatoes have been short supplied on the market to a very weak demand, all lines below prime being hard to quit. Pumpkin supplies have been plentiful to a steady demand for prime lines. Growers are inclined to rush their pumpkin in too early to secure the high values ruling early in the season and the market becomes flooded with immature lines that are not only hard to quit but tend to lower values all round. Swedes were

heavily supplied during December and were practically unsaleable. Consignments then ceased until the latter end of January, when they were in demand at high values. Cabbage supplies have been plentiful all through and values have steadily increased until at present they are at their peak for twelve months. Peas were plentiful and during the Christmas season were heavily supplied, causing values to maintain a steady level. Beans also were heavily supplied and values were down to glut level, several times early in the quarter. During January values firmed and continued firm to the end of the period. Brown onions have been plentiful to a steady demand and values have been steady. Lines of extra quality generally realised more than the average, for there is always a special market for this quality. White onions plentiful early in the period but are now easy in supply and values are firmer. Rock melons have not been so heavily supplied this season, growers generally reporting a light crop. Late varieties, mainly "Best of All" and "Rocky Ford," are good sellers, and these are making good values. Water melons have been shorter in supply this season than generally, the large majority being small and mis-shapen. Prime samples have sold well throughout. Marrows have been well supplied to a steady demand, and good lines firm. Cucumbers have been heavily supplied and prime lines sold well all through the period. Celery has been plentiful since the season started and values for prime quality has been firm; small and green lines are not good sellers. Rhubarb has been heavily supplied and growers have had a lean time, values being very low, the heavy glut of stone fruit being the main cause. Bunch lines have been heavily supplied and values were easy during the first part of the quarter, but since have firmed and remained steady. Lettuce supplies were short to a keen demand at high values throughout the quarter.

Eggs.—Early in December supplies were heavy to a slightly firmer demand. Metropolitan new laid hens, 1s. 3d. to 1s. 5d. Supplies eased slightly towards the end of December, and values advanced to 1s. 4½d. to 1s. 6½d. After the holidays the demand was not so keen and prices a little easier. Hen eggs, 1s. 4d. to 1s 5d. During January prices remained unaltered, but early February saw a decreased supply and a small advance in values, 1s. 5d. to 1s. 7½d., with higher values towards the end of February, 1s. 7d. to 1s. 9½d. During the last 10 days the demand has been keen and on March 8th hen eggs realised 2s. 0½d. to 2s. 2d.

Poultry.—Early December supplies were heavy with good demand for Christmas trade, high values realised, prime cockerels 11s. 6d. to 14s. 6d. Middle December saw a heavy supply with quality not so good and demand not so keen. Prime cockerels, 10s. to 11s. 6d.; turkeys were slow of sale, the quality not being satisfactory. After the holidays prices eased, cockerels being 8s. 6d. to 10s.; prime Muscovies (drakes), 10s. to 12s. 6d. During January cockerels were in demand, but Muscovies and aged birds hard to quit. During February prices were lower and Muscovies receded to 8s. to 9s. 6d. Early March supplies lighter and demand good for prime quality cockerels, 8s. to 11s. 6d. Muscovies, 8s. to 12s. 6d.

Carcase Meat.—Our sales opened on December 13th to a representative gathering and prices realised were satisfactory. Sales are held Friday at 9 a.m. and increased supplies to a good demand have been the rule. February saw improved values for lambs and pork, no alteration during early March, except that veal also showed better values.

Latest prices.—Prime pork, 10¼d. to 10¾d.; medium pork, 9d. to ½d. Veal, prime calves, 8¼d. to 9½d.; medium calves, 7d. to 7¼d. Lamb, 6½d. to 7d. Mutton, 4¼d. to 4¾d.

METEOROLOGICAL INFORMATION.

Stations	Temperature.				Rainfall.		Temperature.				Rainfall.		Temperature.				Rainfall.	
	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	DECEMBER, 1929.						JANUARY, 1930.						FEBRUARY, 1930.					
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	90·7	11·7	60·2	52·0	0·03	0·23	95·7	112·7	61·8	53·2	0·00	0·28	94·2	112·4	63·0	54·1	0·00	0·50
Geraldton	81·9	102·0	61·8	50·0	0·04	0·16	82·8	111·0	63·5	55·0	0·00	0·22	81·0	100·4	65·0	54·8	0·00	0·30
Walebing	89·3	111·0	58·2	47·9	1·18	0·48	96·1	117·2	60·9	54·1	0·00	0·36	93·9	108·2	61·0	51·2	1·43	0·50
Perth	82·0	100·0	60·4	52·0	0·38	0·57	85·9	108·0	62·9	54·1	0·05	0·35	84·3	101·8	62·7	53·2	0·12	0·44
Kalamunda	82·8	103·5	58·3	47·0	0·53	0·78	89·5	107·5	60·7	51·0	0·00	0·57	87·3	102·0	60·8	51·0	0·25	0·67
Bunbury	78·8	95·7	56·5	44·2	0·24	0·59	81·9	98·0	57·3	46·5	0·02	0·45	80·2	94·0	56·9	47·0	0·09	0·54
Bridgetown	84·3	100·0	50·9	36·0	0·74	0·78	90·3	109·0	51·3	38·0	0·00	0·55	89·9	101·4	50·9	39·0	0·05	0·67
Albany	71·0	96·0	56·5	49·0	2·17	1·14	74·4	106·0	59·2	51·5	0·06	0·85	73·4	94·0	59·3	49·0	0·42	0·95
Merredin State Farm	89·1	106·5	59·7	46·0	0·05	0·55	95·4	112·3	66·4	51·2	0·00	0·50	94·9	104·7	62·2	52·4	0·01	0·60
Northam	90·3	110·0	59·2	50·0	0·12	0·35	96·7	115·2	61·5	53·0	0·00	0·29	94·2	107·1	61·5	52·9	0·03	0·39
York	89·3	110·0	57·5	48·5	0·08	0·32	95·2	115·2	60·0	51·0	0·00	0·28	92·6	106·0	61·0	51·0	0·00	0·51
Narrogin State Farm	85·5	105·0	52·1	41·3	0·12	0·60	90·8	110·7	54·7	44·4	0·00	0·34	87·5	101·2	55·1	47·3	0·25	0·58
Katanning	82·8	102·7	52·9	44·5	0·21	0·61	89·6	110·9	54·9	44·4	0·00	0·39	85·8	100·7	56·6	48·4	0·11	0·58
Cape Leeuwin ...	70·7	81·8	60·0	53·0	0·68	0·84	73·7	102·0	61·7	56·0	0·11	0·68	72·3	80·0	61·3	59·0	0·18	0·87

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FOREWORD.

The Farmers of Western Australia—

In many of us there is an inherent desire to serve our country, but not to everyone is given the opportunity that lies within the scope of the Department of Agriculture. The honour of administering this Department has been conferred upon me by the Head of the Government of this State, and it is due to you, the people of the agricultural districts, that I came within the ambit of his choice.

My thanks can be better expressed by action during my term of office rather than by words, yet I welcome the present opportunity of assuring you, through these pages, that I am thoroughly alert to the responsibility, importance, and opportunity of my position as head of the Department of Agriculture.

A native of the State, having spent most of my life in farming pursuits here, the success of the industry is my paramount ideal. Having been taught in the hard school of experience, my sympathy with you is assured and must form a close tie between us.

Realising the invaluable influence spread throughout the land by the Department of Agriculture, evidenced by improved practices consequent upon the lessons of experience, the discoveries of science, and the inestimable contributions these have made to the safe and rapid progress of agriculture in its widest scope, I have a very lively sense of its effect on our national development and income. Nature has endowed us with wonderful resources, which are ours to organise and exploit for the creation of national wealth and the general happiness and welfare of our people. I believe this can best be accomplished by listening to the voices of science and experience. The best known available sources for obtaining and collating the material have been brought together in the department now under my control, and the information is distributed per medium of the "Journal of Agriculture" by officers of the various branches of the Department specially appointed to their tasks. My aim will be to increase their usefulness so that the problems and difficulties of the pioneer settler and the advanced agriculturist will be investigated and eventually solved.

I am very grateful that, as one of the earliest acts in my new sphere, I was able to make an announcement regarding the generous offer of Mr. M. T. Padbury to contribute the sum of £150, in order to make provision for permanent prizes to encourage the production of bigger and still bigger crops of wheat in Western Australia.

This is to be achieved by providing for a perpetual competition amongst wheat growers whose area harvested for grain is not less than 200 acres, the competition to be won by the grower producing the greatest number of bushels of wheat per inch of rain received during the growing period.

To achieve this object, it is proposed that part of the sum donated shall be utilised for the purchase of a suitable trophy, which shall be held by the winner for one year, or until such time as it is won by some other grower; the balance of the money to be held in trust by the Royal Agricultural Society, of which Mr. M. T. Padbury is a former President, and the interest used to purchase a replica of the trophy, which shall be presented to and remain the property of the winner of the competition each year.

The trophy itself is to be sufficiently large to contain a suitable inscription setting forth the objects of the competition, and also contain the names of the successful competitors. The replica will have on it the name of the winner for the year in which it was won, but not the names of the other winners.

Having been closely associated with Mr. Padbury for a great number of years, I am not surprised at his generosity in this matter, for I know how keenly he is interested in the development and expansion of the agricultural industry in W.A., and the wheat section of that industry in particular.

This patriotic action on the part of Mr. Padbury should commend itself to not only the wheat growers of W.A., but to all those who have the welfare of the State at heart. It should have the effect of stimulating interest in those farmers who consistently produce good crops, and there is no doubt the friendly spirit of rivalry that it will engender will have a beneficial effect. The winning crops year by year will be inspected by neighbouring farmers, and some at least of these will be induced to emulate the methods of the winner of the trophy and those competitors whose crops rank high in the competition. Its effect must be to help to increase our yield per acre, and thereby our annual production.

At the moment we are experiencing a difficult situation, but it cannot avert, or for long retard, our march of progress. Prosperity is ahead of us if we have the will to succeed. With past successes to sustain and inspire us, and given a good season, I look to you confidently for co-operation in producing a record harvest this year in every branch of the industry, thus counter-attacking the demon of depression.

Yours faithfully,

Minister for Agriculture.

THE MINISTER FOR AGRICULTURE.

THE BATEMAN CENTENARY WHEAT GROWERS' CUP.

I. THOMAS,
Superintendent of Wheat Farms.

The Bateman Centenary Wheat Growers' Cup was donated by the family of the late J. W. Bateman, a gentleman who had watched and helped in the progress of the State since its earliest days as a colony. In order to link his name with the Centenary Celebrations of the State, and to show the keen interest he had taken in the State's progress, his family donated a gold cup, the product of Western Australian mines, valued at £50, to be presented to the farmer in this State whose wheat crop grown during the Centenary year (1929) gained the highest merit. Thus the two primary industries (gold mining and wheat farming) which have performed the greatest part in the State's progress, and the name of one of the most respected and loyal of her citizens are inseparably linked, and the aim of the late Mr. J. W. Bateman's family has been realised on the State's one hundredth birthday.

The competition was unique in the Commonwealth and possibly in the whole world. Invariably crop awards are made for the highest average yield per acre irrespective of the climatic conditions under which the competing crops are grown. It was desired to make this award for merit, and, as the competition was State wide, to endeavour to eliminate the advantages due to climatic conditions. It was therefore decided to make the award to the farmer who obtained the highest yield per acre for each inch of rain which fell during the conventional growing period (*i.e.*, from 1st May to 31st October inclusive).

The conditions under which the competition was conducted are as under:—

1. The cup was awarded for the crop grown during 1929, the Centenary year, to the grower who obtained the best average acre yield per inch of rainfall during the conventional growing period, viz., from 1st May to 31st October inclusive.

2. The rainfall upon which the award was made was determined by the Commonwealth Meteorologist from the district records, and his decision in this matter was final.

3. The competition was limited to those farmers who harvested at least 200 acres of wheat for grain. Where a competitor was financially interested in the crops grown on one or more farms, the total areas were included in the competition.

4. The average yield was ascertained from the total area harvested for grain and determined from the actual amount of wheat sold as shown by the delivery dockets plus the amount retained for seed and home use.

5. The method of judging was as follows:—The judge visited the farm of the competitor and at a convenient time measured up the stripped area and ascertained the quantity of wheat on hand. On or before 31st January, the farmer was required to furnish the judge with a sworn declaration as to the quantity of wheat sold from the competing holding, and the amount retained for seed and other purposes. The statement regarding the amount sold was supported by agents' dockets. The judge, after satisfying himself as to the correctness of this statement, computed the average yield per acre from the information received.

6. The judge was appointed by the Director of Agriculture and his decision is final.

7. Nominations for this competition were received by the Royal Agricultural Society up till the 31st of October, 1929.

The number of entries received was 110, but 87 only of the entrants fully complied with the conditions. These were located throughout the wheat belt, from Ogilvie in the North to Mukinbudin in the East and to Tambellup in the South.

Time, and the number of officers available, did not permit the area cropped by each competitor being measured up. It was decided, therefore, to obtain a statutory declaration from each entrant, and to measure up those who had a possible chance of winning. Many of the competitors, however, were taking part in the District Wheat Yield Challenge Shield Competition and were measured up in that connection. It so happens that of the first ten competitors in the tabulated list, in one case only was it necessary for the area to be measured up specially for the Bateman Cup Competition.

Before finality could be reached the disposal of all wheat harvested by competitors had to be checked to ascertain the total yield of each. In some cases the checking presented its own peculiar difficulties and gave rise to subsequent delay. In this connection thanks are due to the wheat merchants for their assistance in supplying details of wheat supplied to them from the different competitors.

The detailed results of the competition are tabulated below, together with a tabulated list of the rainfalls officially recorded at the nearest stations to the individaul competitors, kindly supplied by Mr. E. B. Curlewis, of the Commonwealth Meteorological Bureau:—

RESULTS.

Competitor.	Address.	Rainfall, 1929.			Yield.		
		Total points.	Growing Period, points.	Area harvested acres.	Gross B. lbs.	Average per acre, B. lbs.	Average acre per inch G.P. Rain, B. lbs.
McDonald. J. ...	"Springvale," Gnowangerup	1,613	1,087	279	10,233-56	36-41	3-22
Lohoar, W.	Borden	1,576	942	292	8,377-59	28-41	3-2
Richards, T. ...	South Caroling ...	...	917	380	1,0391-0	27-21	2-59
Formby, R. & Co., Ltd.	Formby Siding, *via* Gnowangerup	1,508	1,021	227	6,652-24	29-18	2·52
Mouritz, E. A. ...	Pallinup, *via* Gnowangerup	...	965	200	5,303-0	26-11	2-49
Willard & Willard ...	"Yladgee," Gnowangerup	1,613	1,087	249	7,551-24	30-20	2-47
Stone, J. D. ...	Borden	1,576	942	584	15,217-8	26-3	2-46
Booroondara Grazing Co., Ltd.	Toompup, nr. Ongerup	1,655	1,003	216	6,000-12	27-46	2-46
Murray, W. W. ...	Borden	1,576	942	423	10,773-0	25-28	2-42
Chambers, E. ...	Pallinup	...	965	280	6,951-21	24-49	2-34
Darby, A. H. ...	Lake Grace ...	1,604	959	200	4,802-8	24-1	2-30
Rudduck, S. A. ...	"El Cala," Coorow	1,265	975	860	20,907-0	24-19	2-29
Tom Moore	Indarra	1,290	1,082	300	7,856-18	26-11	2-25
Moir, C. C.	Arnelup, *via* Borden	1,851	1,089	220	5,776-28	26-15	2-25
Carter, R. & Sons ...	Three Springs ...	1,236	1,055	333	6,997-0	25-16	2-24
Stone, S. G. ...	Borden	1,576	942	231	5,177-0	22-25	2-23
Wilson, A. F. ...	Moulyinning ...	...	982	550	12,678-23	23-3	2-21
Prowse, E. W. ...	Doodlakine ...	1,383	874	453	8,629-24	19-3	2-11
Mott, C.	Moulyinning ...	...	982	249	5,298-0	21-17	2-10
Nottage, R. B. ...	Tammin	1,497	1,130	249	6,029-0	24-13	2-8
Smith, C. & Sons ...	Bruce Bock ...	1,365	963	2,765	56,972-0	20-36	2-8

RESULTS—continued.

Competitor.	Address.	Rainfall, 1929. Total points.	Growing Period, points.	Area harvested acres.	Yield. Gross B. lbs.	Average per acre, B. lbs.	Average acre per inch G.P. Rain, B. lbs.
Deane, Hammond J.	"Cuttening," Kellerberrin	1,548	1,107	300	7,059-0	23-32	2-8
Bishop, H. F. ...	Lake Grace ...	1,604	950	212	4,269-0	20-8	2-7
Mott, H.	Moulyinning ...	...	982	222	4,619-0	20-48	2-7
Troy, M. F. ...	Indarra	1,290	1,082	364	9,233-44	25-22	2-5
Thomas, C. F. & Sons	Three Springs ...	1,236	1,055	526	11,512-12	21-53	2-4
Prowse Bros. ...	Doodlakine ...	1,383	874	1,349	23,193-0	17-12	1-58
Eckermann, H. W.	Yandanooka ...	1,651	1,429	257	7,214-52	28-4	1-58
Saunders, W. S. ...	Yandanooka ...	1,651	1,429	241	6,735-8	27-57	1-57
Ellis, M. P. & E. G.	Bruce Rock ...	1,365	963	206	5,538-29	18-42	1-56
Hornsby & Son ...	Moulyinning ...	...	982	344	6,504-20	18-54	1-56
Garrett, G.	Bruce Rock ...	1,365	963	697	12,973-28	18-37	1-56
Cousins, A. H. ...	Three Springs ...	1,236	1,055	700	14,204-0	20-17	1-55
Clark, R. W. ...	"Rosebury," Carnamah	1,458	1,171	750	16,669-43	22-14	1-54
Johnston, J. H. ...	Nungarin	1,255	787	575	8,531-8	14-50	1-53
Creagh, Bros. ...	Nungarin	1,255	787	1,060	15,697-0	14-49	1-53
Woodbourne, J. ...	Lake Grace ...	1,348	950	281	5,018-0	17-50	1-53
Nichols, R.	Kulin	1,536	972	751	13,662-10	18-12	1-52
Folland, S. L. ...	"Enfield Park," Waddy Forest	...	953	590	10,390-0	17-37	1-51
Hocking, H. R. ...	Tammin	1,497	1,130	392	8,041-25	20-31	1-50
Trotter, A. W. ...	Kulin	1,536	972	464	8,292-22	17-52	1-50
Johnston, H. C. ...	Kulin	1,536	972	723	12,938-35	17-54	1-50
Fitzpatrick, R. C. ...	Nungarin	1,255	787	783	11,200-48	14-18	1-49
Henderson, J. H. ...	Kulin	1,536	972	483	8,572-47	17-45	1-49
Clarke Bros. ...	Moulyinning ...	...	982	315	6,014-54	19-6	1-47
Cook, W. T. ...	Burracoppin ...	1,616	936	400	6,691-0	16-44	1-47
Green Bros. ...	"Bushy Park Farm," Carnamah	1,458	1,171	640	13,200-58	20-38	1-46
Strutton, A. R. ...	Three Springs ...	...	1,055	546	10,216-3	18-43	1-46
Braysher, F. E. & Son	Kellerberrin ...	1,548	1,107	487	9,597-0	19-42	1-46
Brown, J. A. ...	"Raith," Yandanooka	1,651	1,429	270	6,608-0	24-28	1-43
Cusbert, L. C. ...	Bruce Rock ...	1,365	963	559	9,295-0	16-38	1-43
Quartermaine, R. ...	Yandanooka ...	1,651	1,429	229	5,616-0	24-31	1-43
Dumsday, L. ...	Goomarin ...	...	892	590	9,669-0	15-13	1-42
Mackin, C. C. ...	Tammin	1,497	1,130	558	10,454-0	18-44	1-40
Barr, D. F. ...	"Glen Laurall," Shackleton	991	1,441	610	9,975-5	16-21	1-39
Smith, H.	Yandanooka ...	1,651	1,429	545	12,760-4	23-25	1-38
Clarke, A. & J. ...	Kellerberrin ...	1,548	1,107	688	12,403-0	18-2	1-38
Muntz, J. N. & Son	Bruce Rock ...	1,365	963	379	5,840-0	15-24	1-36
Spillman, D. J. ...	Doodlakine ...	1,383	874	855	12,211-0	14-17	1-36
Uppill, G.	Tammin	1,497	1,130	902	16,157-25	17-55	1-35
Mann, J. W. ...	Tammin	1,497	1,130	609	10,755-0	17-40	1-34
Jenkins, R. M. ...	Corrigin	1,583	1,118	586	10,293-24	17-34	1-34
Bowron, L.	"Rockwell," Corrigin	1,583	1,118	590	10,390-0	17-20	1-33
Crossland, J. L. ...	Corrigin	1,583	1,118	990	17,053-31	17-13	1-32
Spillman, J. W. ...	Doodlakine ...	1,383	874	910	12,042-48	13-14	1-31
Howe, Bros. ...	Kulin	1,536	972	318	4,710-54	14-49	1-31
Browning, H. ...	Yandanooka ...	1,651	1,429	222	4,862-9	21-54	1-31
Laurence, H. N. ...	Ogilvie	1,532	1,265	502	9,467-18	18-52	1-30
Horsman, H. & Sons.	Corrigin	1,583	1,118	561	9,159-26	16-20	1-28
Gibbs, R. T. ...	Kellerberrin ...	1,548	1,107	352	5,641-1	16-2	1-27
Reynolds, A. G. ...	Mukinbudin ...	...	710	1,335	13,700-54	10-16	1-27
Inverarity, D. H. ...	Kellerberrin ...	1,548	1,107	548	8,633-0	15-45	1-25
Inzard, A.	Ogilvie	1,532	1,265	927	16,382-49	17-40	1-24
Fisher, A. G. ...	Doodlakine ...	1,383	874	591	7,477-55	12-39	1-23
Fulwood, C. ...	Corrigin	1,583	1,118	352	5,480-31	15-34	1-23
Dwyer, J.	"Ullaring," Southern Brook	1,490	1,196	590	9,669-0	16-23	1-22
Jewell, J. D. ...	Corrigin	1,583	1,118	602	9,181-21	15-15	1-22
Atkinson, A. G. ...	Ogilvie	1,532	1,265	597	9,839-39	16-29	1-18
Mableson, H. H. ...	Doodlakine ...	1,383	874	764	8,706-53	11-24	1-18
Cripp Bros.	Ogilvie	1,532	1,265	600	9,827-5	16-23	1-18
Horan, A. G. ...	Ogilvie	1,532	1,265	1,429	22,274-0	15-34	1-13
Gard, T.	Kukerin	2,186	1,394	320	5,135-12	16-3	1-13
Bahr, E. O. ...	Kukerin	2,186	1,394	337	5,312-14	15-46	1-8
Faulkner, W. J. ...	Kukerin	2,186	1,394	372	5,874-29	15-47	1-8
Michael, L. G. ...	Roundhill ...	2,054	1,656	302	5,172-0	15-24	1-5
English, J. C. ...	Kukerin	2,186	1,394	931	13,932-32	14-28	1-4
Sugg, M.	Kukerin	2,186	1,394	434	6,210-55	14-19	1-2

RAINFALL RECORDS FOR BATEMAN CUP.

District.	Jan.	Feb.	Mar.	Apl.	Useful Rains.							Nov.	Dec.	Total for Year.
					May.	Jne.	Jly.	Aug.	Sep.	Oct.	Total.			
Gnowangerup	33	135	12	32	303	309	123	123	150	79	1,087	282	32	1,618
Borden ...	19	119	23	39	198	261	99	106	159	119	942	330	104	1,576
Clare-Vale ...	65	48	85	12	241	328	181	122	35	10	917	107	*Nil*	1,234
Formby Siding	30	94	17	26	291	263	106	120	147	85	1,021	292	28	1,508
Ongerup ...	32	37	30	26	192	318	92	104	202	95	1,003	453	74	1,655
Clear Hills ...	7	136	11	43	306	289	86	81	129	74	965	*	*	*
Lake Grace ...	29	47	88	18	215	332	161	125	72	21	926	234	6	1,348
Koobabbie ...	1	215	10	*Nil*	373	333	131	78	10	50	975	55	9	1,265
Wolverden ...	2	91	4	3	435	335	114	159	29	10	1,082	108	*Nil*	1,236
Arnelup ...	6	64	30	63	219	312	128	113	188	107	1,067	567	54	1,851
Three Springs	*Nil*	62	11	*Nil*	330	409	124	147	25	20	1,055	108	*Nil*	1,236
Moulyinning...	25	56	70	20	260	307	124	103	123	65	982	319	9	1,481
Doodlakine ...	*Nil*	162	120	3	203	322	183	130	8	28	874	217	7	1,383
Tammin ...	4	132	104	11	283	412	252	121	30	32	1,130	110	6	1,497
Bruce Rock ...	*Nil*	55	114	7	253	312	216	120	21	41	963	223	3	1,365
Kellerberrin ...	3	116	140	5	277	368	278	101	38	45	1,107	173	4	1,548
Yandanooka...	*Nil*	58	25	7	415	536	205	207	48	18	1,429	131	1	1,651
Carnamah ...	26	113	22	8	352	425	214	121	35	24	1,171	118	*Nil*	1,458
Nungarin ...	4	144	87	8	279	249	104	86	14	55	787	225	*Nil*	1,255
Waddy Forest	*Nil*	197	12	3	307	320	148	92	30	56	953	64	*Nil*	1,229
Kulin... ...	36	26	134	40	240	371	190	122	24	25	972	327	1	1,536
Burracoppin...	19	181	113	5	409	277	93	68	24	65	936	358	4	1,616
Talgomine Downs	14	129	84	*Nil*	399	269	70	68	14	72	892	204	*Nil*	1,323
Corrigin ...	28	24	133	13	318	439	183	104	50	24	1,118	253	14	1,583
Ogilvie ...	*Nil*	45	188	*Nil*	472	410	119	165	47	52	1,265	34	*Nil*	1,532
Meckering ...	2	63	110	3	250	429	250	141	36	90	1,196	63	3	1,490
Mukinbudin ...	4	*	80	*Nil*	291	193	66	62	11	87	710	199	*Nil*	*
Kukerin ...	15	64	91	50	334	406	239	228	115	72	1,394	562	10	2,186
Round Hill ...	32	226	60	2	322	528	245	189	20	103	1,407	72	*Nil*	1,799
Shackleton ...	21	81	120	3	315	327	213	91	25	20	991	214	11	1,441

* Results not available.

Note—

Address.	Nearest Recording Station.	Address.	Nearest Recording Station.
Toompup	Ongerup	Southern Brook ...	Meckering
South Caroling ...	Clare Vale	Coorow	Koobabbie
Goomarin	Talgomine Downs	Indarra	Wolverden
Pallinup	Clear Hills		

It is gratifying to all concerned, and particularly to the donors of the valuable cup, that the competition created such widespread interest and terminated so successfully.

The total area harvested by the 87 competitors was 47,143 acres for a total yield of 875,217 bushels, and an average of 18 bushels 35 lbs. per acre.

The results of the competition are enhanced by the fact that they show two State official records created in our Centenary year.

Both records were made by the winner and are:—

1. The highest average yield per acre from the total stripped area (279 acres) on the farm, viz., 36 bushels 41 lbs. per acre. Previous records 31 bushels 39 lbs. (P. C. Neville, Yandanooka, Dist. Chall. Shield Wheat Yields Competition, 1928-29), and 26 bushels 56 lbs. (T. Richards, South Caroling, Wheat Yields Competition, 1925).

2. The highest average acre yield per inch of rainfall (1st May to 31st October inclusive), viz., 3 bushels 22 lbs. per acre per inch of rain which fell during the conventional growing period. Previous record 3 bushels 19 lbs.

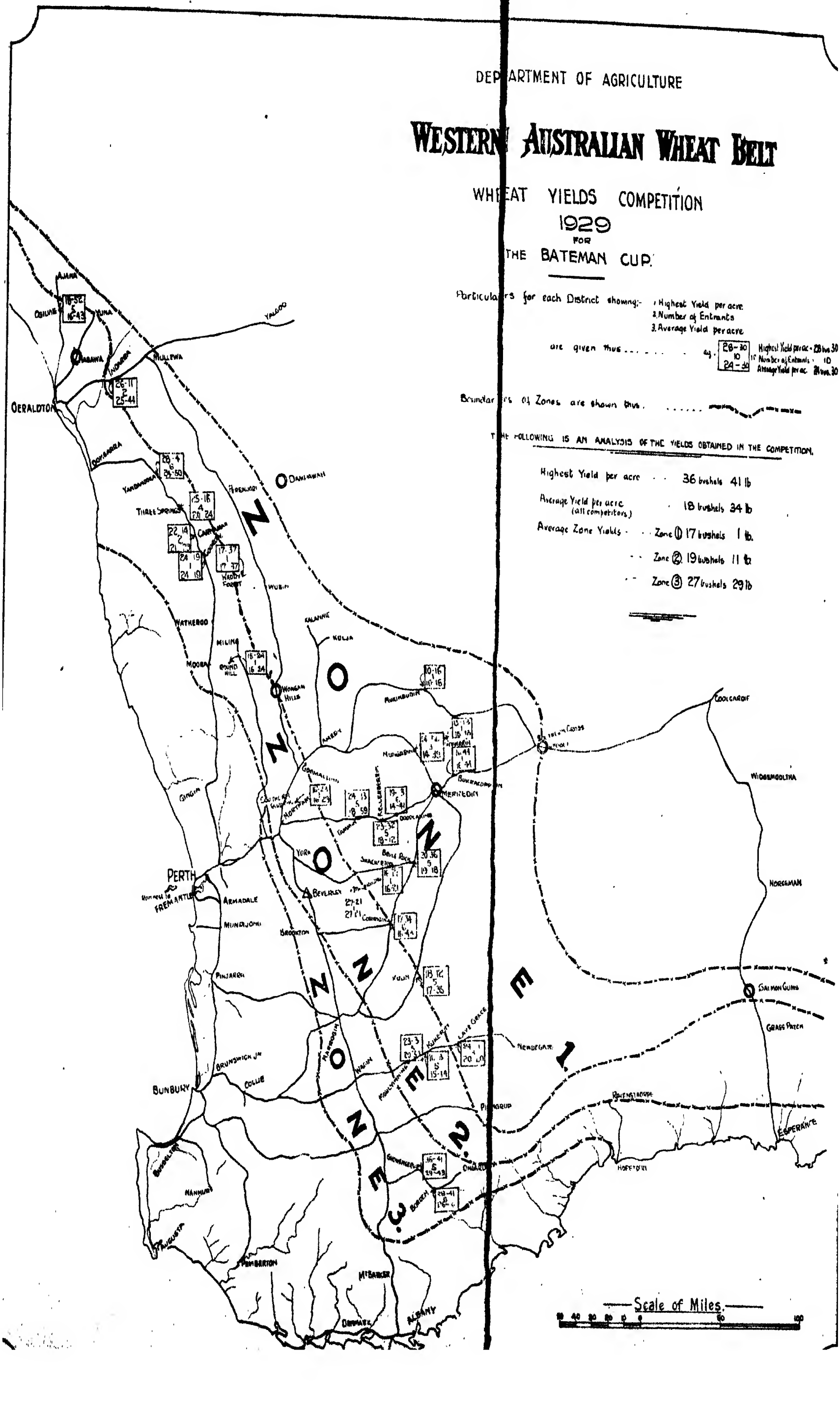
(T. Richards, South Caroling, Wheat Yields Competition, 1925, 801 pts. during growing period).

A special feature of this competition was the endeavour to eliminate the advantages due to climatic conditions. This, however, did not entirely eventuate because the rainfall (as disclosed by the records) favoured those competitors located in the Southern districts. The crops in these districts were benefited by the copious rains which were experienced throughout the wheat belt in November, which month is not included in the conventional growing period (1st May to 31st October). The seasonal rains began early in May and favourable conditions continued until the end of June. During July the rainfall was scanty, but no alarm was felt. The lack of rain in August, however, gave cause for anxiety. At the end of that month the crops showed signs of distress, and, as the adverse conditions continued during September, the position was viewed most seriously and it was feared that the season, which was more promising during the early part, would end with disastrous results. In October belated rains were experienced in some parts of the wheat belt. In the early districts where this rain fell it was too late to be of any use. In the Southern and other late districts, further late rains were experienced even as late as November.

The rainfall and other climatic conditions, which prevailed in some districts during September and October, and in others during July and August also, were such that the maturing of the crops was hastened, and in consequence, the November rains were too late to be of any benefit to them. In fact, in some cases, harvesting operations were about to commence at the time of these rains. Despite the advantages the winner and others gained by the beneficial rains late in the season, their performances are meritorious, but there are other competitors whose performances, in view of the scanty rainfall and other adverse climatic conditions prevailing during September, October, and in some cases also in August, are none the less praiseworthy.

Although adverse conditions prevailed throughout portion of the growing period, the excellent average yield of 18 bushels 34 lbs. was obtained. This is most encouraging and shows that sound farming methods are being practised and again emphatically indicates that the State average of 10 to 12 bushels is below what can be expected when sound farming methods are adopted.

The accompanying map of the W.A. Wheat Belt shows the locations of the competitors. The detailed figures for each district show the highest individual yield and the average yield for all competitors in that particular district.


DEPARTMENT OF AGRICULTURE
WESTERN AUSTRALIAN WHEAT BELT
WHEAT YIELDS COMPETITION
1929
FOR
THE BATEMAN CUP.
Particulars for each District showing:-
1. Highest Yield per acre
2. Number of Entrants
3. Average Yield per acre
are given thus ...... eg. 28-30 / 10 / 24-30
Highest Yield per ac. - 28 bus. 30
Number of Entrants - 10
Average Yield per ac. 24 bus. 30
Boundaries of Zones are shown thus ......
THE FOLLOWING IS AN ANALYSIS OF THE YIELDS OBTAINED IN THE COMPETITION.
Highest Yield per acre .. 36 bushels 41 lb
Average Yield per acre (all competitors) . 18 bushels 34 lb
Average Zone Yields ... Zone (1) 17 bushels 1 lb.
.. Zone (2). 19 bushels 11 lb
.. Zone (3) 27 bushels 29 lb
ZONE 1.
ZONE 2.
ZONE 3.
GERALDTON
MULLEWA
YALGOO
DALWALLINU
THREE SPRINGS
WATHEROO
MOORA
WONGAN HILLS
KALANNIE
KOLJA
MERREDIN
COOLGARDIE
WIDGEMOOLTHA
NORSEMAN
SALMON GUMS
GRASS PATCH
ESPERANCE
RAVENSTHORPE
HOPETOUN
NEWDEGATE
LAKE GRACE
KUKERIN
ONGERUP
PINGRUP
WAGIN
NARROGIN
BROOKTON
BEVERLEY
YORK
NORTHAM
GINGIN
PERTH
FREMANTLE
ARMADALE
MUNDIJONG
PINJARRA
BRUNSWICK JN
COLLIE
BUNBURY
BUSSELTON
NANNUP
AUGUSTA
PEMBERTON
MT BARKER
DENMARK
ALBANY
Scale of Miles.

"BLACK SPOT" OR "SCAB" OF APPLES AND PEARS IN WESTERN AUSTRALIA.

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Although the disease known as "black spot" or "scab" of pears (caused by the fungus *Venturia pirina,* Aderh.) has been present in Western Australia for many years, and has, for the last decade or so, annually caused considerable reduction in the quantity and quality of the pear yields of very many of our orchards, the related disease on the apple (caused by *Venturia inaequalis,* (Cke.) Wint.), has, up till the present, been quite unknown. This fact, combined with the absence of codlin moth (*Laspeyresia pomonella,* L.), has made the life of the Western Australian apple grower, from a spraying point of view, at least, a particularly easy one.

Western Australian apples have always been noted, *inter alia,* for the clearness and brightness of their skins: and this desirable brightness, absence of surface blemishes due to "scab" or codlin moth, greater nearness to the market, and greater average maturity at picking time of Western Australia's fruit in contrast to that from some of the other Australian States (2), have all contributed to establish our apples in a particularly high place in the estimation of English and Continental buyers. It is very fervently to be hoped that this state of affairs will long continue, but, with the outbreak of "apple scab" within our borders, a rather serious blow may well have been struck at the easy continuance of the high standard of excellence of much of our apple crop.

HISTORY OF "BLACK SPOT" OF APPLES IN WESTERN AUSTRALIA.

In 1902 McAlpine (8), writing on "Black Spot of the Apple" stated,—"It has made its appearance in all the Australian States and seems to thrive well where the climate is neither too hot nor too dry." By implication, therefore, McAlpine stated that "black spot" was present in Western Australia as early, at least, as 1902. Whether he was guilty of too hasty a generalization, or whether the disease actually was present here at that time and later on died out, we at present have no reliable means of telling. Certain it is that the disease has not been known to officers of this Department, during all the years apples have been grown in Western Australia, until April of the present year, and until then not a single apple tree in the whole State had ever been sprayed, to the Department's knowledge, for its control.

In 1925, Mr. W. M. Carne, at that time Economic Botanist and Plant Pathologist to this Department, writing on "A Preliminary Census of the Plant Diseases of South-Western Australia" (1), made the following interesting remarks in connection with certain previous records of fungi in Western Australia published in the writings of various authors, including McAlpine, viz.:—"The writer has considered it advisable to omit some of the references therein given, while others have been somewhat doubtfully included. *These remarks apply to important diseases of economic plants which*

are unknown to the field officers of this Department and to the writer. If they do occur they are certainly not of economic importance in this State. Such diseases include Apple Scab (Venturia inaequalis) . . ."*

On page 32 of the Empire Marketing Board Special Report No. 3, 1928, occurs the following statement under the heading "*Venturia inaequalis*—Scab or Black Spot":—"Fruit showing signs of scab injury was not observed until half-way through the season, when it was first noticed on Tasmanian Sturmer Pippin apples. *Later it was seen on Western Australian fruit.*"*

This statement led to a communication on the matter dated 5th June, 1928, by Mr. Carne to the Secretary of the Empire Marketing Board, in which it was pointed out that the disease was not known by Departmental

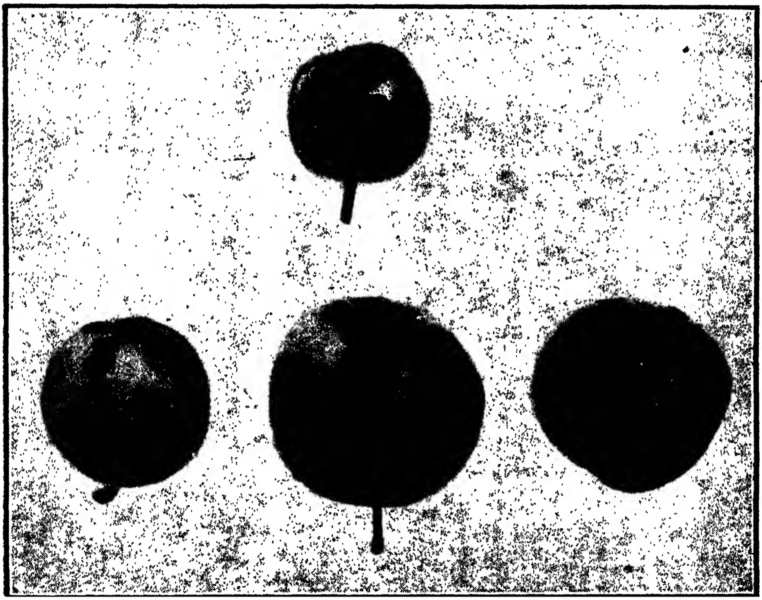

Fig. 1.—Cleopatra apples from Manjimup badly affected with "Black Spot" or "Scab" due to *Venturia inaequalis*.

Photo. by Author.

officers to be present in Western Australia, but that full details of the fruit concerned would be welcomed so that the orchard and the trees affected could be located. The Secretary, in reply, regretted that the particular information required could not be supplied, as the apples in question had been examined by a mycologist no longer in the service of the Board, and it had been impossible, in the absence of his personal notebooks, to trace the name of the grower or growers concerned.

On 4th April of this year a small number of Cleopatra apples badly affected with *Venturia inaequalis* (see Fig. 1) were brought to this office by

* The italics are mine.—H.A.P.

Mr. J. Ramage, of Paterson & Co., Perth, from Manjimup, this constituting the first unquestionable record of the disease in Western Australia. The fungus was in a very active condition, each of the lesions being covered with thousands of the very typical, greenish-brown, spores of the *Fusicladium* stage. (See Fig. 4.) A visit to the district by the Director of Agriculture (Mr. G. L. Sutton), the Superintendent of Horticulture (Mr. G. W. Wickens), and the writer, on 8th April, revealed that the fruits on about a dozen Cleopatra trees, well inside the boundaries of a single orchard, were seriously affected; several smaller lesions being also found on a few Granny Smith fruits, and numerous, newly-formed, lesions on the leaves of a large number of trees of various varieties in the vicinity of the badly-affected ones. No other orchards in the district were found to be affected, but on 29th April a number of Granny Smith apples from an orchard at the Porongorups, about 100 miles away, were also received at this office, and found to be affected with the *Fusicladium* stage of the scab fungus. In both instances rigorous spraying and other measures were immediately taken in an attempt to wipe out the disease, and every effort is now being made by the Superintendent of Horticulture and his staff of Orchard Inspectors to determine if other orchards are affected, so that further measures appropriate to the situation may be at once instituted. In view of the fact that the majority of the young apple trees for planting in Western Australian orchards have always been obtained from Victoria, in which State the disease has long been serious and widespread, it is rather surprising that the apple-growing industry of this State has for so long remained free of this disease, which is held by many authorities to be, perhaps, the most serious of all apple troubles.

In view of the comparative dryness of the summer conditions of the main apple-growing districts in Western Australia, the disease, should it prove to be impossible of eradication, will probably never be as serious here as in, say, Victoria and Tasmania, where the summer humidity is, on the whole, much greater than in our main apple-growing districts. Nevertheless, as can be seen from the photographs of affected apples from Manjimup (Fig. 1) and the Porongorups (Fig. 2), the disease, when uncontrolled, is capable of causing very considerable damage. It therefore behoves all growers to be on the watch for the first sign of the trouble on their properties, and then immediately to take all the necessary steps to control the disease and prevent it ever reaching a serious condition. As a matter of fact, preventive measures in the form of spraying, etc., would seem very well worth while in the case of orchardists situated at all close to the two present places of outbreak.

This article is written with the chief object of calling attention to the seriousness of the disease, the symptoms by which it may be recognised, and the control measures, by which, if they are conscientiously carried out, the disease, which is quite a controllable one, can be prevented from ever seriously detracting from the quality or quantity of the great bulk of Western Australia's apple crop.

DISTRIBUTION AND ECONOMIC IMPORTANCE OF APPLE "SCAB" OR "BLACK SPOT."

"Black spot" or "scab" of apples has now been recorded from all the States of the Commonwealth. It occurs also in England, on the Continent wherever apples are grown, in North America, South Africa, and New

Zealand. Indeed, its distribution seems to be almost as wide as apple culture, a fact which is not surprising, if the contention of certain writers, that it occurred on the wild parents of the apple, be true. Wherever it occurs it

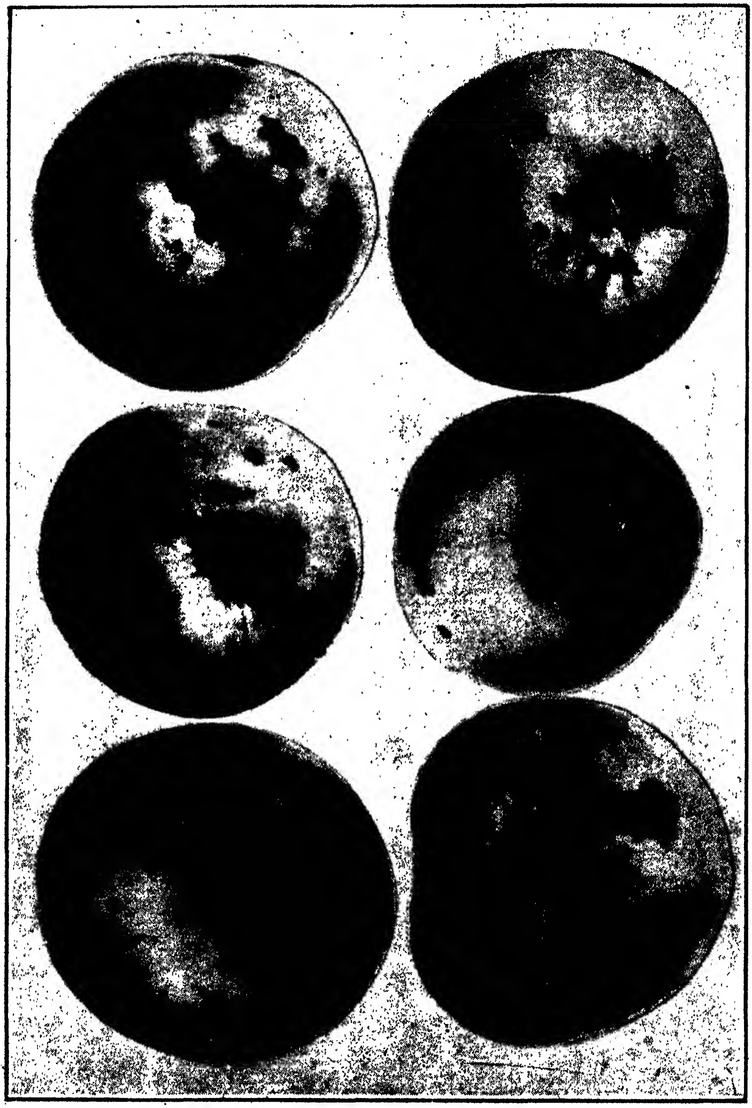

Fig. 2.—Granny Smith apples from the Porongorups affected with "Black Spot" or "Scab" due to *Venturia inaequalis*. The small size of many of the lesions is due to the fact that much of the infection occurred when the apples were almost fully grown, and only a short time before the photograph was taken.

Photo. by Author.

is much more serious in cool, moist climates than where the spring and summer climate is usually hot and dry, although even there it may do enormous damage in the occasional seasons favourable to its development.

Heald (7) states that in the United States of America the annual loss, even on the most conservative estimate, runs into millions of dollars, and that in Australia the average annual loss per acre has been estimated at nearly £10. In the State of Montana in U.S.A., in the years 1911 and 1912 the disease caused a loss of 15 per cent. of the crop. These few figures will indicate that the disease is not to be lightly regarded. It is, indeed, by many authorities considered the most serious apple trouble. Cunningham, for example (3), in referring to the economic importance of the disease in New Zealand, states that, "Black spot is the most serious apple disease with which the orchardist has to contend, as it not only weakens the tree by damaging the leaves, but reduces the market value of the fruit through the development of disfiguring spots, scabs, and cracks on the epidermis (skin). In cases of severe infection the crop may become a total loss, owing to the developing fruits being so damaged as to fall to the ground at the time of setting or

Fig. 3.—*Left*—Rome Beauty apple leaf showing early stage of infection with the "black spot" fungus. *Right*—An old Jonathan leaf carrying winter spores (*ascospores*) of the "black spot" fungus in *perithecia* embedded in the dead tissues.

After J. Farrell, Vict. Journ. Agric., 1919.

shortly after. As a result of fruit infection loss may be caused in four ways:—(1) The fruits may fail to set owing to being killed outright by the fungus; (2) young fruits may fall to the ground; (3) fruits may become distorted, badly scabbed, or cracked, and thus be rendered unsaleable; (4) the quality of the fruit and its keeping properties may become impaired by the development of disfiguring marks on the surface."

"In the last case the disease does not result in the rotting or breaking down of the tissue of the apple, as is the case with bitter-rot and other similar fruit-rotting fungi. On the contrary, the most noticeable effect may be a mere superficial disfigurement of otherwise mature and healthy fruit; nevertheless, this defect in quality is often enough in itself to render a large

portion of a crop unsaleable. Serious as this may be, it is by no means the worst feature of black spot: in several ways it may directly reduce the *quantity* of fruit. This aspect of the disease is more liable to pass unnoticed, but it is immeasurably more disastrous in its results. Black spot thus affects the quantity as well as the quality of the output—the two factors on which the profit of the orchardist depends."

LIFE HISTORY OF THE APPLE "SCAB" ORGANISM, AND ITS EFFECTS ON APPLE LEAVES, SHOOTS, AND FRUITS.

"Black Spot" or "Apple Scab" is caused by a fungus known scientifically, in the sexual or perfect stage, as *Venturia inaequalis*, (Cooke) Winter, and in the non-sexual condition as *Fusicladium dendriticum*, (Wal.) Fel. The disease is carried over from year to year almost entirely by means of infected leaves, which, on falling to the ground in the autumn, harbour the fungus within their dead tissues, and in doing so provide it with the nourishment required to produce large quantities of fungus seed-bodies, or *spores*, during the winter months. These spores (called *ascospores*) are produced in thick-walled, flask-like, fungal-structures known as *perithecia*, each of which, as indicated in Figure 6, lies snugly buried in the tissues of a dead leaf. These *perithecia*, which are each only about the diameter of a "full stop" on this page, (9) are gradually formed by the fungus during the passage of the winter months, and a very large number may be formed within the tissues of a single leaf. (Fig. 3.) Each *perithecium* eventually comes to contain many thousands of spores, each spore being produced, along with seven others, in a little sac-like envelope known as an *ascus* (see Fig. 4). Each spore or fungus seed-body is divided into two compartments, or *cells*, of which the top one is somewhat shorter, but broader near the base, than the other. Now the time taken for the production and maturation of these *ascospores* is such that, given normal climatic conditions, the *ascospores* are just about ready to be set free to fend for themselves, and restart the disease, at the very time that the apple trees are bursting forth into leaf and blossom. When, then, the mature *perithecia*, in the dead leaves on the ground below the trees, become thoroughly moistened by the occurrence of a shower of rain, or in any other manner, "the *perithecia* and certain portions of the *asci* swell to such an extent that the enclosed *asci* are subjected to considerable pressure, thus forcing out their contained *ascospores* through the *perithecia*, into the air. So great is the pressure developed by the swelling of these hygroscopic (water-absorbing) portions that the entire *perithecium* sometimes is shattered, *asci* and *spores* being ejected into the air with considerable force, the embedded base of the *perithecium* alone remaining in the leaf-tissues. Not only is abundant moisture essential for the discharge of the *ascospores*, but it must also be present on the leaves before an *ascospore* can germinate or its *infection-hypha* ("fungus-root") pierce the cuticle (*i.e.*, the transparent rubber-like covering of the skin of fruit, blossom, shoot, or leaf)." (3.)

On germination each cell of an *ascospore* produces a narrow fungal tube called a *germ-tube* (or *infection-hypha*), which is capable of infecting the surface of a leaf, blossom, fruit, or young twig whenever the proper conditions prevail (10). "Considerable moisture in the form of rain or heavy fogs is a requisite for spore germination and infection. In general, cool, wet weather is conducive to the germination of the spores and infection of the host. On the other hand, hot, dry weather is unfavourable for the

spread of the disease. If very dry weather prevails for a few weeks during the time of blossoming and unfolding of the leaves, there is little opportunity for the primary ascospore infections to occur, and there will be few conidia (spores produced during the growing period) for secondary infection." (Owens, 1928) (10).

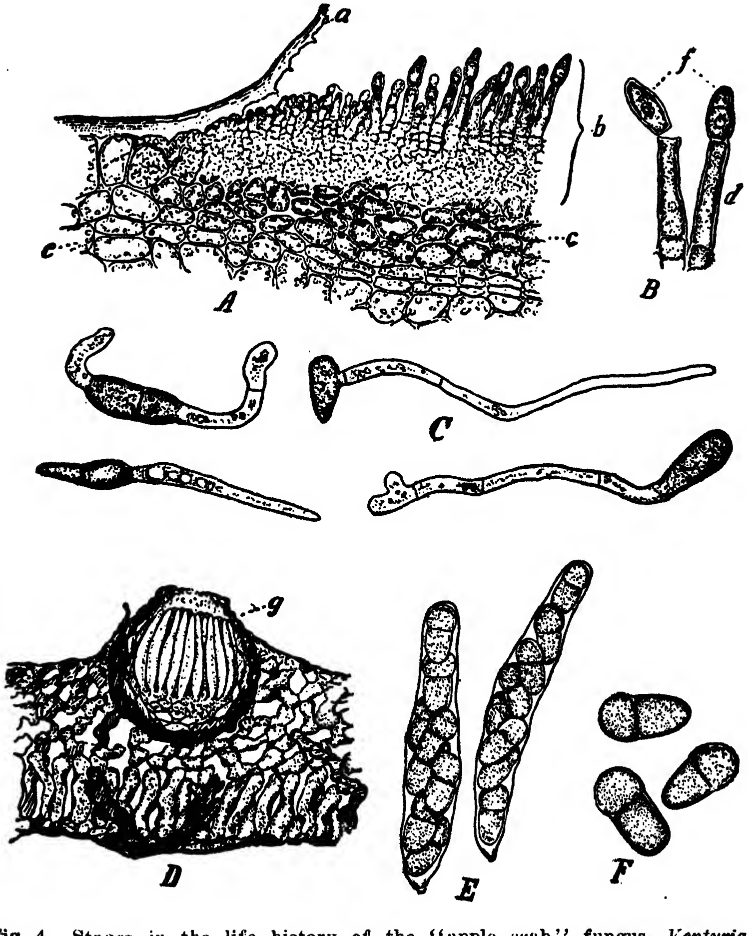

Fig. 4.—Stages in the life history of the "apple scab" fungus, *Venturia inaequalis*:—

A. Portion of a section through a "scab" spot on an apple fruit, showing the fungus forcing up the cuticle of the epidermal cells and producing a number of greenish-brown *conidia*.

B. Two spore-producing structures (*conidiophores*) with a *conidium* at the tip of each.

C. Four *conidia* in the process of germination.

D. Section of a dead apple leaf showing a *perithecium* of *Venturia inaequalis* embedded in the tissues.

E. Two *asci* with *ascospores* inside.

F. *Ascospores*. (After Longyear, from Stevens' "The Fungi which cause Plant Disease.")

From the primary infections caused in the spring by the *ascospores*, subsequent infections may be brought about during the remainder of the season by means of a special type of spore known as a *conidium* (plural *conidia*) (see Fig. 4). These *conidia* may be formed, after the passage of several weeks time, in enormous numbers on any tissue infected by the fungus. When seen under the microscope they are greenish-brown in colour, somewhat tooth-shaped (being broader at one end than the other), and sometimes divided by a transverse wall into two separate cells. (Fig. 4.) They may be carried away by wind, or rain, to other leaves, flowers, fruits or shoots, on which, in the presence of abundant moisture, they may germinate, as indicated in Fig. 4, within a few hours of becoming mature. By means of a germ-tube they may then penetrate the cuticle and give rise to further lesions. In mass, the *conidia*, which constitute the only type of spores produced on living tissues, appear black, and thus give the intense and characteristic blackish colour to infected areas on leaves, blossoms, fruits or shoots, when in the spore-producing condition (Figs. 1, 2, 3, 5, 7, and 9). It is this conidial stage of the fungus which is known as *Fusicladium dendriticum*; the perfect or sexual stage, produced in the tissues of dead leaves, being the *Venturia form* of the organism.

EFFECTS OF THE "APPLE SCAB" FUNGUS ON LEAVES, BLOSSOMS, FRUITS, AND SHOOTS.

Symptoms of "scab" upon the *leaves* may be of two distinct types. The more common type takes the form, when young, of more or less circular, greenish-brown, or greyish-green spots with a very much branched and tree-like structure, readily discernible under a lens, at the margins. Later in the season, the spots, under favourable conditions, may produce large numbers of spores, and in this condition they appear olive-green or almost black (Figs. 3 and 5). As the spots become larger they often blister up, and the dark, velvety surface then becomes smoother, duller, or sometimes shining and graphite-like in colour, as the spores are rubbed, washed, or blown away.

In the other type of leaf infection the fungus spreads in a very diffuse, or indefinitely-outlined, manner, over the tissue of the leaves, giving somewhat the impression of a kind of sooty-mould. although the fungus is really below the cuticle and not above it as in the latter case. This type of lesion is most common on the bottom sides of the leaves, and tends to follow along the direction of the main veins.

Both these forms were seen by the author in the case of the outbreak at Manjimup reported above. "When the scab spots are abundant or when the diffuse form is severe there may be more or less reduction in the size of the leaves with curling and distortion. In the severe diffuse type much leaf tissue is killed and the affected leaves or portions of them may appear as if scorched or burned . . . The diseased areas may appear on either surface of the leaves, but the earliest infections are most frequently upon the lower surfaces"—(Heald, 1926) (7).

On the *fruits* the scab lesions first become obvious as small, brownish or black, irregular or circular spots without any break in the skin. With increase in the size of the lesions the *cuticle*, or transparent rubber-like coating over the first layer of cells, becomes ruptured (see Figs. 4 and 7), and the interior of the lesion then appears velvety and dark brown, or almost black, with an irregular and considerably frayed and torn, silvery-white,

margin, which is the ruptured cuticle. This silvery-white and much lacerated cuticle can often be seen in the early stages with the naked eye, but it is, of course, much more readily distinguished with a hand lens. Under the lens the centres of newly-formed, smallish lesions, often have a mottled silvery-white and black appearance, due to the alternation of black patches of spores and pieces of ruptured cuticle. Many of the fruits infected in the early stages (see Fig. 8) fall to the ground, but large numbers may persist on the trees. In such a case many of the infected apples will become badly dis-

Fig. 5.—"Black spot" or "apple scab" lesions on apple leaf.
After Mason, "Spraying, Dusting and Fumigating of Plants."

torted (Figs. 1 and 8), owing to the more rapid rate of growth on the part of the healthy portions giving an unsymmetrical development. With increase in the size of the fruits and the lesions, the centre parts of the diseased areas often become bare, corky, and somewhat cracked or fissured, the edges of each lesion still, however, remaining infected and dark in colour, owing to the continual production of spores (Fig. 9). It is this phase of the disease which has given rise to the common name "apple scab." Once the centre of a fruit lesion has become hard and corky, any further increase in the growth of the

still healthy portions of the fruit may lead to the development of very large and unsightly cracks in the diseased area (Fig. 8). When fully-grown, or almost fully-grown fruits are infected very late in the season, the lesions usually remain small, and the centres rarely become bare and corky. (Figs 2 and 9). If apples recently infected with the scab fungus, or bearing *conidia* on their surfaces, are placed into cool or open storage, lesions may develop in the store.

In the case of *blossom* infection, lesions may appear on the flower-stalks (*pedicels*), petals, calyces, or young fruits. The lesions may be many and small, or of a diffuse and spreading nature. As a result of blossom infection there may be very considerable reduction in the amount of fruit set, besides great reduction in the quality of much that persists.

"Scab" lesions on the *twigs* are stated to be confined to the bark of one-year old shoots (Heald, 1926) (7). "Young lesions on the twigs are very similar in appearance to those on the fruits, showing the central spore surface bordered by the unlifted epidermis (skin). Later in the season, the spores may disappear and the bark show a more scaly character, due to the peeling of the bark in flakes. . . . The twig lesions may be few and scattered, and thus may be easily overlooked, or they may be so numerous as to coalesce and produce more extended affected areas" (7). The lesions on the shoots may play a part in carrying the disease over from season to season, where the winter conditions are mild, as they may, under such conditions, produce a fresh crop of *conidia* in the following spring.

VARIETIES AFFECTED.

So far, only "Cleopatra" and "Granny Smith" apples have been found affected in Western Australia. Thomas (11) in Tasmania in 1925, stated that, "In general, the least susceptible varieties are those that blossom late in the season, such as London Pippin (Five Crown), Worcester Pearmain, Winter Majetin, and Geeveston Fanny, whilst amongst the worst affected varieties are Cleopatra, Scarlet Pearmain, and Delicious."

Darnell-Smith and Mackinnon (5) in New South Wales in 1915 gave lists as follows:—"Among those that appear *susceptible* are:—Ben Davis, Cleopatra, Delicious, Esopus Spitzenburg, Gravenstein, Irish Peach, Maiden's Blush, McIntosh Red, Dunn's (Munroe's) Favourite, Newtown Pippin, Northern Spy, Pomme de Neige (Fameuse or Lady of the Snows), Ribston Pippin, Rokewood, Scarlet Nonpareil, Stone Pippin, Sturmer Pippin, Twenty Ounce, Winesap, Winter Pearmain, and Yates."

"Those apparently *least affected* are:—Alexander, Baldwin, Cox's Orange Pippin, Duchess d'Oldenburg, London Pippin (Five Crown), Grimes, Hoover, Jonathan, Reinette de Canada, Rome Beauty, Rymer, Statesman, and Wealthy."

I have been unable, in the time available before going to press, to locate any later Australian lists.

"BLACK SPOT" OR "SCAB" OF PEARS.

The disease known as "black spot" or "scab" of pears (Fig. 11) has been present in Western Australia for many years, and has annually caused considerable reduction in the quantity and quality of the yield in many orchards. So serious has been the loss caused by the disease to many growers in the

Albany, Mount Barker and Bridgetown districts, for example, of recent years, that many have spoken quite seriously of uprooting their pear trees if a better state of affairs does not soon prevail. It may as well be stated, here and now, that there is no need to go to any such extreme lengths, or to take such a pessimistic view of the situation, as "pear scab," like "apple scab," is a readily controllable disease, if the growers will only tackle the job in a determined and aggressive way and go the right way about it. Control

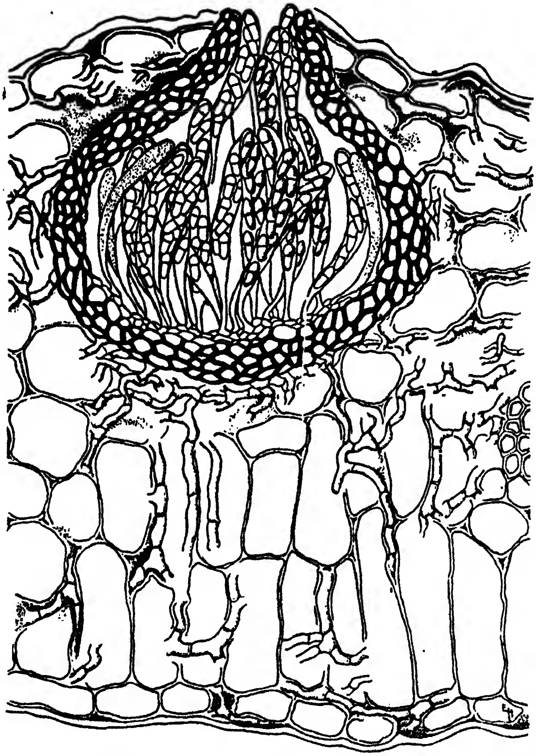

Fig. 6.—*Venturia inaequalis* on apple leaf. Section through a *perithecium* embedded in a dead leaf, showing the *asci* and *ascospores*. *After the drawing by Elsa O. Horn in Owen's "Principles of Plant Pathology."*

measures are given below, which, if conscientiously carried out, will, in the future, undoubtedly reduce the present dominion, pomp, and power of the pear scab fungus, to a mere vestige of its former glory and exalted condition. The very indifferent control of "black spot" or "scab" of pears which many growers have obtained in the past, has been due, to some extent, at least, to the fact that most of our pear growers are, really, to a much greater extent, growers of apples, and as the *pear* fungus does not attack the *apple* trees or fruits, many growers have tended to rely more and more on their apples to return them cheques, and have let the pears "slide." A further contributing factor to the poor control of pear "scab" in many orchards has been the

fact that only *one* spraying, and not a single other control measure, has been invoked in the fight against the pest. Now, although certain growers, for example Orchard Inspector Flintoff at Bridgetown, have obtained very satisfactory control of pear "scab" with only one spraying of Bordeaux Mixture, 6-6-50 strength, at the "pinking stage," other growers, and I have in mind particularly certain orchardists at Mount Barker, have decidedly not done so, even though they have, as they themselves put it, figuratively "slept under the trees to closely observe the development of the buds and blossoms, and spray exactly at the right time." *The life-history of the "pear scab" fungus (Venturia pirina, Aderh. = Fusicladium pirinum, (Lib.) Fcl.) is identical in all its*

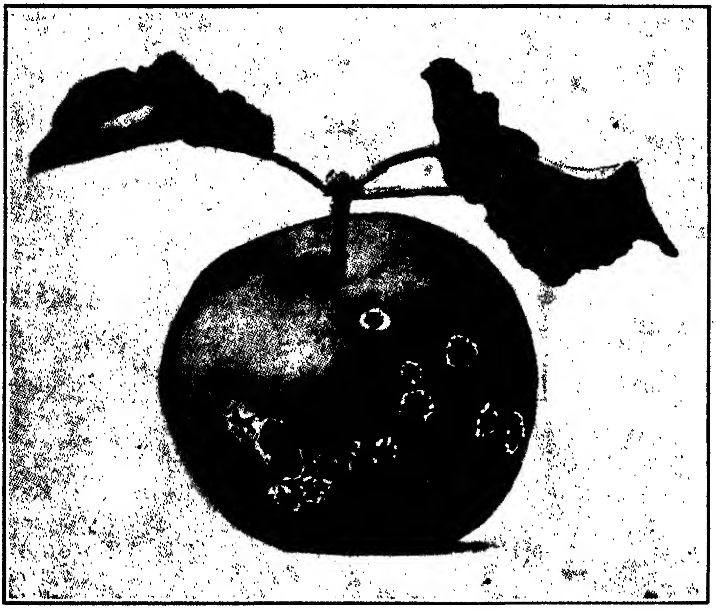

Fig. 7.—"Black Spot" or "Scab" of apple due to *Venturia inaequalis*, showing the silvery-white broken cuticle at the margin of the lesions. *After Craig (from Stevens' "Diseases of Economic Plants")*. (Somewhat modified.)

main features with that of the "apple scab" fungus already dealt with. The two fungi are, however, although closely related, quite distinct, and the pear fungus cannot attack the apple, or the apple fungus the pear. The only other important difference is that while infection of the shoots in the case of the apple is comparatively rare, in the case of the pear, shoot infection is much more frequent, and therefore much more important as a contributing factor in carrying the disease over from year to year. "The fact must not be lost sight of, however, that *perithecia* are produced abundantly on fallen leaves, and that *ascospores* produced therein infect the leaves and fruits of the pear in the spring." (Cunningham, 1925) (3.)

CONTROL OF THE "BLACK SPOT" OR "SCAB" DISEASES OF APPLE AND PEAR. GENERAL CONSIDERATIONS.

As both the apple and pear "scab" organisms are so closely related, and their life-histories so similar, the control measures to be taken for each are, of necessity, except for slight differences in detail, identical.

In each case the main reliance must be placed on systematic, routine spraying, but certain auxiliary practices will, when intelligently carried out, assist materially to reduce each of these diseases to comparatively negligible amounts.

The harm done to any phase of rural industry by such diseases as apple and pear "scab" is usually not attributable to any lack of suitable control measures, but to the fact that, in many cases, only a small proportion of the growers can be induced to carry them out efficiently; and in this, rather than in the actual outbreak of apple "scab" itself, for example, lies the only serious menace to the continued high standard of our apple-growing industry, should the disease succeed in exceeding the geographic limits to which, at present, it appears to be confined. Apple "scab" need hold no terrors for the fruit growers of Western Australia, if it is only intelligently and aggressively combatted. Western Australia has, indeed, been singularly fortunate to have remained for so long free from this disease, which, as stated above, is practically world-wide in its distribution and occurs almost everywhere apples are grown. In all the other Australian States, for example, the disease has been known since, at least, 1895, and in Victoria it was recorded as early as 1862 (8), and has been more or less satisfactorily contended with by apple growers ever since. The dry summer climate of much of our apple-growing territory will alone do much to prevent the disease ever assuming overwhelming proportions, and the control measures indicated below should reduce it to a comparatively negligible amount.

Owing to the widely scattered nature of many of our apple-growing districts it is not to be expected that apple growers will take spraying measures against the disease until it actually appears on their individual properties, except in the case of orchardists in the immediate vicinity of the two present outbreaks, but all should be on the watch for the trouble, *and then at the first sign of infection immediately notify this Department and take such steps as may be appropriate to the time of the year, extent of the outbreak, and so on, to prevent the disease ever getting a firm hold. The importance of this last point cannot be too strongly emphasised.*

Growers on whose properties apple "scab" is not yet present should do everything possible to prevent the disease entering their boundaries, by refusing to permit relations, members of their families, etc., to bring apples from other orchards or shops on to their properties. If it is necessary to obtain bud-wood, young trees, etc., from any other orchardist, care should be taken to first ascertain that the other orchard is, so far as can be ascertained at the time, quite free of the disease. In spite of all these precautions, however, the disease may be introduced, as the spores may be carried long distances by wind.

DETAILS OF CONTROL MEASURES FOR "BLACK SPOT" OR "SCAB" OF APPLE OR PEAR.

1. Where the disease is bad, after the fruit has been gathered in the autumn, and before the time when the majority of the leaves normally fall from the trees, give a good spraying with Bordeaux Mixture, 5-4-50.

There is often a renewed activity on the part of the fungus in the autumn when the cool, damp, or dewy weather starts (as at Manjimup and the Porongorups this year), and a good spraying at this time of the season will prevent infection of many still healthy leaves, and will therefore greatly reduce the numbers of *ascospores* to be contended with in the following spring. Any fallen leaves below the trees should also be sprayed.

2. As soon as practicable in the autumn, plough the fallen leaves under the surface, setting the plough to bury them as deeply as possible without unduly injuring the root systems of the trees. Where the plough cannot reach, have the leaves either raked up and burnt, or deeply dug under. The idea of this is to cause as many leaves as possible to rot away before the spring, and to secure that many others shall remain buried when the necessary cultivation is given at that time. The object of burying the leaves as early as possible is that the *warmer* the soil when the operation is carried out, the more complete will be the rotting away of the leaves under the influence of various soil organisms before the spring cultivation. It is very certain that if every fallen leaf could be raked up and burnt in the autumn, there would be very little need for spraying or any other measures to control apple "scab," owing to the fact, already reiterated several times, that apple "scab" is almost entirely carried over from the autumn to the following spring in the dead apple leaves. The same holds true, although to a somewhat lesser extent, in the case of "scab" of the pear. In practice it is impossible to rake up and destroy every leaf, so that the best that can be done is to bury the leaves as deeply as possible in the autumn, and then to set the plough or cultivator to work several inches shallower in the spring, so as to avoid an unduly large number of unrotted leaves coming to the surface at that time. (As a matter of general orchard practice a cover crop should, of course, be grown during the winter, to enrich the soil later on when ploughed in.)

3. When carrying out the summer or winter pruning operations keep a careful lookout for lesions on the wood. Newly-formed lesions will only be found on new or one-year-old shoots. Shoot lesions are much more common on the pear than the apple. Prune out affected parts and burn. In this way one of the sources of carry-over from season to season will be removed.

Details of the spraying programme to be adopted during the spring and summer period are given below.

SPRING AND SUMMER SPRAYING PROGRAMME.

In addition to the above control measures:—

1. Spray the trees at the "delayed dormant," "green-tip," or "spur-bursting" stage (Fig. 10) with Bordeaux mixture, 5-4-50, or Lime Sulphur 1-15, to combat the *ascospores* which will, by that time, in a normal season, be emerging from the dead leaves on the ground. As stated in the section on "Life History of the Fungus" it is the *ascospores* formed in the dead

leaves on the ground that constitute the most important means (in the apple, at least) of carrying the disease over from season to season, and these must

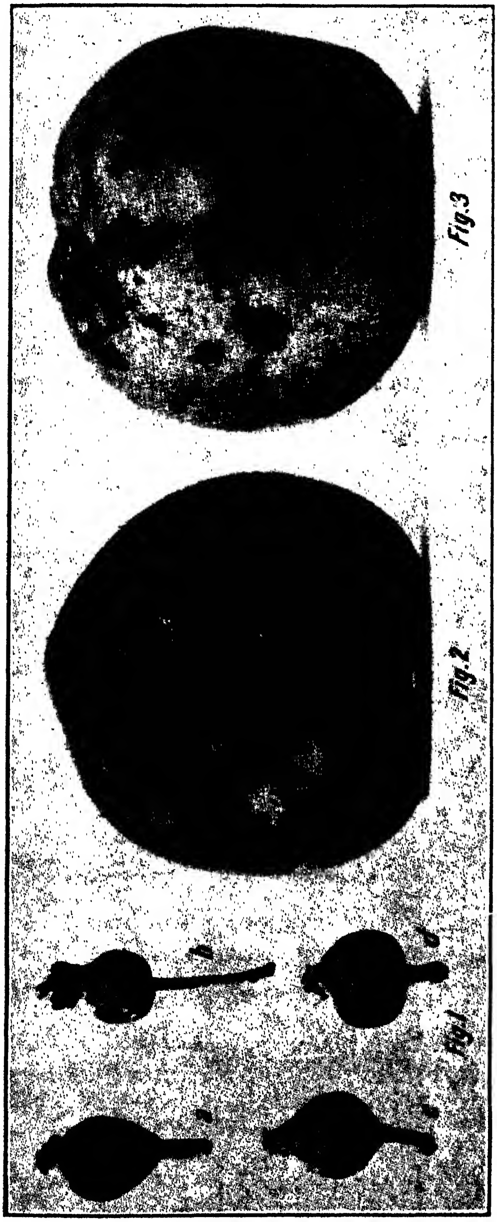

Fig. 8.—*Left*—Four young apples showing early infection with "black spot" or "scab" due to *Venturia inaequalis*. *Centre*—Apple infected at fairly early stage with "black spot" or "scab," showing the very marked distortion and cracking which frequently eventuates in such cases as the apple grows larger. *Right*—Apple infected with "black spot" at a late stage in its life, showing the relatively small lesions formed under such circumstances.

After J. Farrell, Vict. Journ. Agric., 1919.

be prevented from attacking the young leaves, blossoms, and shoots as they develop in the spring. When spraying, spray not only the tree, but the

ground below and about also, as, in this way, many of the *ascospores* formed in the dead leaves are killed without ever reaching the tree (Curtis, 1924) (4).

2. Spray the trees, and the ground beneath and around the trees at, or between, the "pre-pink" ("open cluster") and "pink" stages (Fig. 10) with Bordeaux mixture 3-4-50, or Lime-Sulphur 1-35 to 40 for apples, and 1-35 for pears.

Under some climatic conditions, *i.e.*, where the spring is cool and very moist, two separate sprayings, one at the "pre-pink," and another at the "pink" stage are recommended at the above strengths, but provided that the "delayed dormant" spraying has been given (and the importance of this cannot be too strongly emphasized), only one spraying during this period should be required under Western Australian conditions. *The grower should note carefully that the second spraying is considerably weaker than the first. In the case of apples sprayed with Bordeaux mixture this point is exceedingly important,* as although Bordeaux is a better spray than lime-sulphur for controlling "black spot" or "scab," it is very likely to russet the apple fruits if used only a little too strong at this, or the next stage. To minimize the danger, a nozzle throwing only a very fine mist should be used at these stages, and although the spraying should be thoroughly done, every part of the tree receiving its share, every attempt should be made to use just a little too little, rather than a little too much. Never hold the spray nozzle for any length of time in the same place so that the spray runs like rain off the leaves, blossoms and twigs; the aim should always be to put just so much spray on the plant that it will dry down without causing any appreciable drip from the tree after the operator has left it. *In this connection the use of a spray spreader such as calcium caseinate at the rate of half to one pound per 50 gallons of spray—whether Bordeaux or Lime-sulphur—is very strongly recommended.* This matter is referred to at greater length below. It is also important to remember that Bordeaux is much more likely to cause russetting on apples if applied during cool, moist weather, than if the weather is warm and dry at the time of application. 3-4-50 Bordeaux has no appreciable russetting effects on pears at any stage.

3. At the "petal fall" stage (Fig. 10) spray *apples* with Bordeaux 2-5-50, or lime sulphur 1-50, and *pears* with Bordeaux 3-4-50, or lime sulphur 1-50. The remarks made in the preceding paragraph about moderation in the amount of spray applied, strength of spray and desirability of using a spreader, apply with equal, if not greater, force, at this stage.

4. Under Western Australian conditions further spraying will, in most districts and most seasons, in all probability, not be required. If, however, the season should turn out very moist and cool, or there should be a long sequence of cool, dewy nights and foggy mornings, and for some reason or other the diseases have not been checked, a further spraying with the strengths given under item 3 may be required *ten days after "petal fall," and at monthly intervals thereafter until the onset of hot dry weather definitely precludes any further trouble from the diseases.*

Should, for any reason, spraying ever be required shortly before picking, the formula to use, either for apples or pears, is lime sulphur, 1-100.

The recommendations *re* spraying given above, are summarised in the following table:—

SPRAYING SCHEDULE.

FOR THE CONTROL OF "BLACK SPOT" OR "SCAB" OF APPLE AND PEAR.

All sprays to be used with a spreader (See last section of article).

No.	Time of Application.	Spray to use.	
		Apple.	Pear.
1	"Green-tip," "Spur-bursting," "Delayed dormant"	Bordeaux 5–4–50 or Lime-sulphur 1–15	Bordeaux 5–4–50 or Lime-Sulphur 1–15
2	From "Pre-Pink" ("Open-Cluster") to "Pink"	Bordeaux 3–4–50 or Lime-Sulphur 1–35 to 40	Bordeaux 3–4–50 or Lime-Sulphur 1–35
3	"Petal-fall" ...	Bordeaux 2–5–50 or Lime-Sulphur 1–50	Bordeaux 3–4–50 or Lime-Sulphur 1–50
4	Ten days later than "Petal-fall," *if required*	Bordeaux 2–5–50 or Lime-Sulphur 1–50	Bordeaux 3–4–50 or Lime Sulphur 1–50
5	At monthly intervals thereafter, *if required*	Bordeaux 2–5–50 or Lime Sulphur 1–50	Bordeaux 3–4–50 or Lime Sulphur 1–50
6	Shortly before picking, *if required*	Lime Sulphur 1–100	Lime Sulphur 1–100
7	Autumn, after fruit harvested but before leaves fall, *when disease has been serious during the season*	Bordeaux 5–4–50	Bordeaux 5–4–50

Do not spray with Lime Sulphur if the temperature is above 75° F., or the sunlight is intense. Spraying with Lime Sulphur is best done during dull weather or during the morning or afternoon, and not during the heat and glare of the middle of the day, as under such circumstances a considerable amount of leaf- and fruit-fall may, at times, result. In this connection it should be pointed out that Lime Sulphur is much more likely to cause damage if it follows the use of Bordeaux Mixture earlier in the season, than if Lime Sulphur has been used from the beginning. If Lime Sulphur is to be used at all it should therefore be used right from the "delayed dormant" period.

Lime Sulphur should never be used on Trevitt or Scarlet Pearmain apples after the fruit has set, as these two varieties are very subject to Lime Sulphur injury. Bordeaux mixture, in spite of its russetting tendencies if used somewhat too strong or during cool, moist, slow-drying weather, is more strongly recommended for apple and pear "scab" than Lime Sulphur.

When deciding the correct stage to apply any spray always choose the period when the *majority* of the spurs are at the stage required. Some will always be more backward, and others more advanced, than the majority, but such spurs must be disregarded in deciding on the correct spraying time.

It is important to realize, in connection with the spring sprayings, that it is much more effective to spray the trees several times, at the stages and strengths recommended, than to spray only once, say at the "pinking" stage, with a considerably stronger spray. The reason for this will be readily understood if the section on the "Life History of the Fungus" given above has been clearly comprehended.

Fig 9.—A. Early infection of Delicious apple with the "apple scab" or "black spot" fungus. Note the large size of the spot, black margin, and the russetted central area. Natural size.

B. Late infection on Doherty (Dougherty) apple, showing small size of the lesions formed under such circumstances. Natural size.

Both after the photos. by E. Bruce Levy in Cunningham's "Fungous Diseases of Fruit-Trees."

MAKING OF BORDEAUX MIXTURE.

As very many apple growers in Western Australia have probably never yet prepared their own Bordeaux mixture, a very simple method of doing so is here briefly given. Obtain two sound wooden barrels.

Then, firstly:—In one dissolve, say, 30 pounds (lbs.) of bluestone in 30 gallons of water, *i.e.*, a pound of bluestone to a gallon of water. This can best be done by suspending the bluestone overnight in a sugar bag or cut-down chaff bag, from a stick placed across the mouth of the cask, so that the bluestone is just beneath the surface of the water. The bluestone can also be fairly readily dissolved by placing it in the cask and pouring hot or boiling water over it. It can, of course, readily be dissolved by heating it with water in a copper vessel over a fire, but no metal other than copper can be used to hold a bluestone solution on account of its corrosive action.

Secondly:—Slake 30 lbs. of "freshly-burnt," "stone" or "quick" lime in the other barrel, by first pouring a little water on to it and then making up to 30 gallons with more water. ("Freshly-burnt" or "quick" lime can be obtained from city merchants in air-tight tins.)

If now it is required to make up a 5-4-50 formula, for example, thoroughly stir the cask containing the bluestone, and, if the spray tank holds 50 gallons, dip out 5 gallons of bluestone solution into the tank. Then run water into the spray tank till it is about three-quarters full. Set the agitator going and then strain 4 gallons of lime concentrate through a fine wire, or bagging, sieve, into the tank. Then make the mixture up to the 50 gallon mark. If the spray tank or barrel holds less or more than 50 gallons the method is, of course, the same, but proportionate amounts of bluestone and lime concentrate must be used. (In any formula for Bordeaux mixture the first figure given means pounds (lbs.) of bluestone, the second means pounds (lbs.) of freshly burnt lime, and the third means gallons of water.) Another method, and perhaps the best of all (except that it necessitates two extra barrels) is to first dilute the required amount of lime concentrate in a barrel with water so as to make half the volume required to fill the spray tank, do likewise with the Bordeaux concentrate in another barrel, and then, through hoses let into the bottoms of both barrels, run the diluted lime and bluestone solutions simultaneously into the spray tank, keeping the agitator going during the process.

I am not prepared to recommend commercial, "already prepared," Bordeaux or Burgundy powders, especially for apples, owing to their liability to be somewhat variable in composition, and also because numerous growers throughout the State have, at various times, suffered severe burning of fruit and foliage (pears, oranges, etc.) when using them, although obtaining quite satisfactory results from similar "home-made" sprays.

In the above-mentioned formulae where lime-sulphur is referred to, the commercial lime-sulphur solution is meant. Thus "lime-sulphur 1-15," for example, means 1 gallon of commercial lime-sulphur (testing 33° on a Beaumé hydrometer) to 15 gallons of water. It should be borne in mind that Bordeaux gives best control of both pear and apple scab, but it is inclined to russet the fruit if used a little too strong for the particular stage of the tree at spraying time; therefore, in all but the "delayed dormant" and "autumn" sprays, an excess of lime is used to counteract this tendency. Danger of injury to fruit or foliage by Bordeaux is much more likely to occur if the

trees are sprayed during cool, moist weather, (when the spray takes a long time to dry). Once thoroughly dried no injury can occur. With lime-sulphur, on the other hand, trouble is only likely to occur if used during

Fig. 10.—Stages of Apple Blossom Development.

1. "Green-tip," "delayed dormant" or "spur-burst." 2. "Tight-cluster." 3. "Open-cluster" or "pre-pink." 4. "Pink." 5. "Full-bloom." 6. Petal-fall." 7. Calyx-closed." *After the drawing by N. J. Adamson, in Cunningham's "Fungous Diseases of Fruit Trees."* When deciding the correct stage to apply any spray always choose the period when the *majority* of the spurs are at the stage required.

very hot, dry, periods, in which case there may be considerable fruit and leaf fall. The above formulae have, however, in view of all the necessary climatic and other considerations, been prepared so as to be as far as possible on the fe side.

TEST FOR BORDEAUX MIXTURE.

When making up Bordeaux mixture only the very best "freshly-burnt" "stone" or "quick" lime should be used, as the chief functions of the lime are to neutralize the acid properties of the bluestone and turn it into a compound which is only slowly soluble when once it has dried on the leaves. In all the above formulae, except the "delayed dormant" and "autumn" spray, excess of lime has been used. Should there ever be any reason to suspect that the lime is inferior in quality, or that it is to any extent "water-" or "air-slaked" before using, the following test should be made:—

Dissolve 4 ounces of ferro-cyanide of potassium in one pint of water, and add a few drops of this to a small quantity of the Bordeaux mixture to be tested. The Bordeaux should preferably be tested in a glass vessel. Should any brownish or black discolouration occur, the mixture does not con-

Fig. 11.—Williams Bon Chrietien or Bartlett pears badly affected with "Pear Scab" or "Black Spot" due to *Venturia pirina*.

Photo. by Author.

tain enough lime, hence lime concentrate must be added until on further testing no discolouration is apparent. A rough test which can be made to see if the Bordeaux mixture contains sufficient lime to neutralize the bluestone, is to dip the clean blade of a penknife into the mixture for several minutes. If the mixture does not contain sufficient lime, a reddish-brown deposit of copper will form on the blade and more lime should be added. *Always use a little too much lime rather than a little too little.*

THE USE OF SPREADERS WITH BORDEAUX MIXTURE OR LIME SULPHUR.

Whenever Bordeaux mixture or lime sulphur is used, the spreading, wetting, and adhesive qualities of the spray will be very greatly improved by the incorporation of a special spray "spreader" or "sticker." In addition, the spray, on drying, will settle down into a very thin, well-distributed, and more

or less continuous layer, rather than into a number of scattered spots. The fungicides will therefore prove much more efficient with a "spreader" than without, as where the spray dries up in spots very little, if any, protection is afforded to the tissue in between. Where spreaders are used there is also very much less danger of damaging the leaves or fruit, for the reason that the concentration of the spray is never so intense at any one point as if no spreader is used. Moreover less spray is used, and there is not such a tendency to hold the spray nozzles for some time in the one place to try and *force* the material to wet the tissues and stay on.

The following substances are some of those which have been used from time to time as spreaders or stickers in various sprays:—oils, resins, soaps, glue, milk and molasses, but *calcium caseinate*, a by-product obtained from skim milk, is the only one which has ever become very popular or widely used. It is very successful with lime-sulphur, and also gives very good results with Bordeaux mixture. It should be used with either of these sprays at the rate of one half to one pound (½-1 lb.) per 50 gallons of spray. In mixing, make the required amount of calcium caseinate into a paste in a billycan, jug, or other suitable receptacle, by putting the calcium caseinate into the dry container, and then slowly adding a little water from time to time, stirring all the while, so as to form a thin paste (just in the same way as powdered skim milk is mixed by the experienced housewife for human use). When made into a paste, dilute with water, and add to the mixture in the spray tank, keeping the agitator going during the process.

2. If calcium caseinate is not obtainable, a good brand of *commercial powdered skim milk* may be used instead.

Use ½-1 lb. to every 50 gallons of spray, mixing as indicated for calcium caseinate in the preceding section. Powdered skim milk was recently used by Orchard Inspector Flintoff at Manjimup, and gave very good results. Mr. Flintoff writes:—

> ". . . . . the powdered skim milk as recommended by Mr. Pittman was used at the rate of 1 lb. to 35 gallons. Even with this small quantity the effect appears excellent, the mixture spreading over the surfaces of fruit and leaves like a bloom. Bordeaux used without a spreader dries up in spots and blotches."

3. Various other substances may be used as a substitute for *calcium caseinate* with satisfactory results. These are:—

(a) *Sweet skim milk,* used at the rate of half a gallon to every 50 gallons of spray.

(b) *Flour,* used at the rate of ½-1 lb. to every 50 gallons of spray. Mix with water to a thin paste and then add to the mixture in the spray tank.

(c) Glue, ½ ounce to every 50 gallons of spray. Dissolve in hot water and then add to the mixture in the spray tank.

4. All the above spreaders may, quite safely, and with great benefit, be used with either Bordeaux mixture or lime sulphur.

The following may be used with Bordeaux mixture *only,* viz:—

(a) Good quality *soft soap,* 2-3 lbs. per 50 gallons of spray. Dissolve in water and add to the spray mixture in the spray tank, or barrel, only just before the spray is to be used.

(b) "*Resin-Fish Oil*" soap, 2-3 lbs. per 50 gallons of spray. Dissolve in water and add to the spray mixture in the spray tank or barrel only just before the spray is to be used.

FINAL NOTES.

In using any spray spreader the full amount of spray liquid should not be made up in the spray tank or barrel until *after* the spreader has been prepared and added, so that the strength of the fungicide will always be very much the same whenever it is made up to the same formula. In other words, if making up a 3-4-50 Bordeaux, the *final* volume of the spray, *after* the spreader has been added should be just 50 gallons.

Calcium caseinate and powdered or sweet skim milk are recommended in preference to any other spreaders, as they are very efficient and chemically quite inert, and therefore no undesirable complications can possibly follow their addition to the spray materials.

Finally it should be pointed out that before using the spray apparatus, especially after it has been idle for any length of time, it should be thoroughly washed out to remove any chemicals which may have been left from the previous spraying. This is exceedingly important when the spray being used is a different kind from that previously employed, as, according to Cunningham (3), this mixing of different spray materials in the tank is one of the most frequent causes of spraying injury to plant tissues.

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FARMERS' FIELD TRIALS, 1929.

I. THOMAS,
Supt. Wheat Farms.

WHEAT VARIETY TRIAL, R. W. KIRKALDY, GRASS PATCH.

This experiment was planted with the standard varieties Yandilla King (late maturing), Gluyas Early (early maturing), and Nabawa (midseason maturing) to determine which of the three respective types would be most suitable in the district in which the plots were located.

The plots, each .3 acre in area, were planted on light sandy loam, originally carrying silver salmon, mallee, and tea-tree. The land had been cleared and cropped in 1925. At the end of July, 1929, it had been ploughed to a depth of 3½ to 5 inches with a disc implement (sundercut). During the second week in October it was skim ploughed to a depth of 2½ inches. The land was twice harrowed in February after rain and once again immediately prior to seeding. Seed was sown at the rate of 45 lbs. per acre and superphosphate was applied at the rate of 90 lbs. per acre. The rainfall as recorded at the farm was as follows:—

—	Jan.	Feb.	Mar.	Apl.	Useful Rains. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
1929 ...	120	97	75	29	227	259	142	129	27	68	852	239	123	1,535

The results obtained are tabulated hereunder:—

Seed—45lbs. per acre. Planted 11th May. Super. 22%—90lbs. acre.

Variety.	Computed Yields per Acre. Section 1. bus.	lbs.	Section 2. bus.	lbs.	Average Yields per Acre. bus.	lbs.	Percentage yields per Acre. %
Yandilla King	14	12	15	20	14	46	84
Gluyas Early (Control) ...	17	20	18	0	17	40	100
Nabawa	16	6	15	40	15	53	90

These results indicate that either late, midseason, or early maturing varieties of wheat are suitable for this district. However, the earlier maturing varieties show to better advantage than the later maturing varieties when grown under seasonal conditions such as prevailed in this district during 1929.

FARMERS' FIELD TRIALS, 1929.

G. L. THROSSELL, Dip. Agric., Agricultural Adviser.

Departmental Field Trials were conducted during 1929 on five private farms in the North-Eastern districts of the wheat belt and on two farms in the Corrigin area.

TRIALS IN THE NORTH-EASTERN DISTRICTS.

With Wheat.

Variety Trials.—The early and very early varieties, S.H.J., Geeralying, and Noongaar were tested against the Standard Early variety, Gluyas Early, at Bencubbin, Welbungin, Lake Brown, and East Goomarin.

Rate of Seeding Trials.—The very early variety, Noongaar, was used in these trials at Welbungin, Lake Brown, and East Goomarin.

With Oats.

Variety Trials.—Trials comparing the midseason and early varieties, Guya and Mulga, alongside the Standard Early variety, Burt's Early, were planted at Bencubbin and Kununoppin. At the latter place, however, no result is available, the plots being cut for hay.

With Fodders.

A series of demonstration plots were planted at Bencubbin, while at Kununoppin a few plots were planted, independently, with seeds supplied by the Department.

THE OBJECTS OF THE TRIALS.

In certain areas a misconception has arisen as to the object of these experiments. It will be noticed that the plots with wheat, during the past three years, have been planted from the third week in May onwards and into the fourth week in June. This has been done with a definite object.

Results obtained from experiments conducted at the Experiment Farms situated at "key-positions" throughout the Wheat Belt, and particularly those at Merredin and Yilgarn, have demonstrated that the seeding period is from the middle of April until the end of May, and that the sooner seeding is finished according to the correct time for the particular variety, the better. However, throughout this area there are many farmers who still prolong their seeding operations, for various reasons, well into June. Some of necessity, and others, perhaps, through ignorance. Because of this, these trials were designed to demonstrate—

(a) which variety is most suitable for late seeding;

(b) what rate of seeding would give the best return for late planting.

In any experiments negative results are as important as positive results. It was expected that by planting late in the seeding period fairly low yields would be obtained, and the result will surely demonstrate that farmers should do their utmost to plant the right varieties at the right time: to cease

seeding by the end of May and to start fallowing as early in June as possible. (Readers should refer to the Experiment Farm results, particularly the Time of Planting, Seasonal Variety and Time of Fallowing Experiments published in the March and current issues of the "Journal.")

SIZE OF PLOTS.

All the plots were half an acre in area, being generally thre or four drill widths wide. They were duplicated to reduce experimental error. Buffers, usually two-drill widths, were planted between each plot and cut for hay.

NATURE OF SOILS.

The trials were planted on classes of soil typical of the localities in which they were situated—the details being:—

Bencubbin (B. W. G. Hopwood).—Timber: Mallee, jam and tea-tree scrub. Soil: Light sandy loam.

Welbungin (W. Bagshaw).—Salmon gum and gimlet. Fine red loam, approximating a red morrell type.

East Goomarin (E. Randolph).—Salmon gum, gimlet, and morrell. Fine red loam, approximating a red morrell type.

Lake Brown (J. Mulqueeny).--Salmon gum, gimlet, and mallee. Red sandy loam.

THE SEASON.

The weather conditions, commencing from the beginning of June, 1928, were very adverse. The fallows suffered from the absence of good soaking winter rains which were not augmented by any appreciable falls during the following spring and summer. No rain fell during April to assist weed destruction and seed bed preparation. May and June were characterised by heavy registrations everywhere, benefiting early sown crops but delaying late seeding.

From the beginning of July and onwards the rains gradually became lighter, drought conditions prevailed particularly during August and to the end of October—the last two months of the growing period proving exceedingly dry. It was indeed ironical that heavy rains should fall after the crops had reached maturity, too late to assist them. The total rain which fell on the growing crops, i.e., from germination to maturity, together with the number of rainy days, was as follows:—Lake Brown 247 points (31 rainy days), East Goomarin 345 points (36 rainy days), Welbungin 368 points (32 rainy days). The rainfall up to the end of the growing period is tabulated below:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.						May to Oct.	Rainfall on Growing Crop.
					May.	June.	July.	Aug.	Sept.	Oct.		
Bencubbin	11	84	65	...	302	182	86	100	16	26	712	...
Welbungin	...	90	80	...	352	216	121	84	...	88	861	368
Lake Brown ...	18	64	77	...	278	158	59	54	15	53	617	247
East Goomarin ...	18	144	80	...	352	222	67	67	20	55	783	345

RESULTS.

B. W. G. Hopwood, Bencubbin.

Cultural Details.

The land was fallowed in June, 1928, 4½ inches deep, cultivated with a Springtyne implement in August and again in April. The oat variety trial was planted on 16th and 17th April, while the fallow was harrowed prior to planting the wheats on 25th May. The results obtained are as follows:—

WHEAT VARIETY TRIAL.

Planted 25th May, 1929. Seed 45lbs. per acre. Superphosphate 100lbs. per acre.

——	Variety.	Section 1.	Section 2.	Average, 1929.		Average, 3 years, 1926, 1927, and 1929.	
		Yield per acre.	Yield per acre.	Yield per acre.	Per-cent.	Yield per acre.	Per cent.
		bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
1	S.H.J.	12 18	11 26	11 52	99	15 16	103
2	Gluyas Early ...	12 18	11 45	12 2	100	14 50	100
3	Geeralying	12 14	12 56	12 35	106	...	...
4	Gluyas Early ...	11 45	12 0	11 53	100	14 50	100
5	Noongaar	12 26	13 2	12 44	107	13 14	89

W. Bagshaw, Welbungin.

Fallowing was completed by 30th June, being ploughed to a depth of 4in. It was cross ploughed on 30th June and cultivated with a Springtyne cultivator on 31st August, 23rd March, and 21st May. Germination took place on 2nd June. The varieties did not stool very well and made very little growth, only averaging about 2ft., and matured about 10th October. Noongaar showed out well during the dry spells. The results are as hereunder:—

RATE OF SEEDING TRIAL.

Variety—Noongaar. Planted 24th May, 1929. Superphosphate—90lbs. per acre.

Plot.	Rate of Seed per acre.	Section 1.	Section 2.	Average, 1929.		Average, 3 years, 1926–29.	
		Yield per acre.	Yield per acre.	Yield per acre.	Per cent.	Yield per acre.	Per-cent.
		Bus. lbs.	Bus. lbs.	Bus. lbs.		Bus. lbs.	
1	30lbs.	3 30	2 56	3 13	84	12 6	89
2	45lbs.	3 37	4 1	3 49	100	13 40	100
3	60lbs.	3 51	4 21	4 6	107	14 18	105

WHEAT VARIETY TRIAL.

Planted 24th May, 1929. Seed—45lbs. per acre. Superphosphate—90lbs. per acre.

Plot.	Variety.	Section 1.	Section 2.	Average, 1929.		Average, 3 years, 1926–29.	
		Yield per acre.	Yield per acre.	Yield per acre.	Per-cent.	Yield per acre.	P
		bus. lbs.	bus. lbs.	bus. lbs.		bus,. lbs	
1	S.H.J.	2 44	2 21	2 33	66	12 ?	
2	Gluyas Early ...	4 10	3 34	3 52	100	15	
3	Noongaar	4 16	4 17	4 17	111		

J. Mulqueeny, Lake Brown.

Fallowed early in June 3½ inches deep. Springtyne cultivated in August, January, March, and May; harrowed in August and January. The wheats germinated on 9th June and matured about 20th October. As elsewhere, stooling and growth were retarded. Noongaar ripened about a week ahead of the others. The following tables give the results obtained:—

RATE OF SEEDING TRIAL.

Variety—Noongaar. Planted 29th May, 1929. Superphosphate—112lbs. per acre.

Plot.	Rate of Seed per acre.	Section 1.	Section 2.	Average, 1929.		Average, 1927-29.	
		Yield per acre.	Yield per acre.	Yield per acre.	Per cent.	Yield per acre.	Per cent.
		bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
1	30lbs.	8 22	10 50	9 36	88	9 44	96
2	45lbs.	10 32	11 14	10 53	100	10 8	100
3	60lbs.	11 2	11 22	11 12	103	10 32	104

WHEAT VARIETY TRIAL.

Planted 29th May, 1930. Seed—45lbs. per acre. Superphosphate—112lbs. per acre.

Plot.	Rate of Seed per acre.	Section 1.	Section 2.	Average, 1929.		Average, 1927-29.	
		Yield per acre.	Yield per acre.	Yield per acre.	Per cent.	Yield per acre.	Per cent.
		bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
1	S.H.J.	7 34	7 54	7 44	89	7 39	83
2	Gluyas Early ...	8 34	8 44	8 39	100	9 16	100
3	Geeralying	7 32	7 48	7 40	89	*5 46	*79
4	Gluyas Early ...	8 44	8 26	8 35	100	9 25	100
5	Noongaar	8 30	†7 52	8 11	95	8 32	90

* Geeralying—Average for two years, 1928 and 1929.
† Outside plot suffered from November storm.

E. Randolph, East Goomarin.

Fallowed in July to a depth of 3½ inches. Cultivated with a disc implement (Sundercut) in September, with a Springtyne in February, harrowed end of March, Springtyne cultivated May 22nd and harrowed 3rd June. The plots were planted on 4th and 5th June and germinated 16th June, maturing about 30th October. Stooling and growth poor, Gluyas Early growing the tallest with a height of 15 inches. The following are the results:—

RATE OF SEEDING TRIAL.

Planted 4th June, 1929. Variety—Noongaar. Superphosphate—90lbs. per acre.

Plot.	Rate of Seed per acre.	Section 1.	Section 2.	Average, 1929.		Average, 3 years, 1927-29.	
		Yield per acre.	Yield per acre.	Yield per acre.	Per cent.	Yield per acre.	Per cent.
		bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
1	30lbs.	7 54	7 36	7 45	94	10 44	95
2	45lbs.	8 30	8 0	8 15	100	11 18	100
3	60lbs.	8 50	8 50	8 50	107	11 27	101

WHEAT VARIETY TRIAL.

Planted 5th June, 1929. Seed, 45lbs. per acre. Superphosphate, 90lbs. per acre.

Plot.	Variety.	Section 1.	Section 2.	Average, 1929.		Average, 4 years, 1926-29.	
		Yield per acre.	Yield per acre.	Yield per acre.	Per cent.	Yield per acre.	Per cent.
		bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
1	S.H.J.	3 48	4 18	4 3	53	9 43	73
2	Gluyas Early ...	7 40	7 40	7 40	100	13 22	100
3	Geeralying	5 6	5 44	5 25	69	*7 28	78
4	Gluyas Early ...	7 40	8 8	7 54	100	13 26	100
5	Noongaar	7 6	9 14	8 10	103	12 3	90

*Geeralying, two years average, 1928 and 1929.

Summary and Discussion of Results.

The following table shows the percentage yields for 1929 and the averages from which comparisons can be made:—

—	E. Randolph, East Goomarin.		W. Bagshaw, Welbungin.		J. Mulqueeny, Lake Brown.		B. W. G. Hopwood, Bencubbin.	
	1929.	3 years average.	1929.	3 years average.	1929.	3 years average.	1929.	3 years average.
Rate of Seeding—Variety Noongar								
30lbs.	94	95	84	89	88	96	...	...
45lbs.	100	100	100	100	100	100	...	...
60lbs.	107	101	107	105	103	104	...	...
		4 years average.		3 years average.		3 years average.		3 years average.
Variety Trial—								
S.H.J.	53	73	66	82	89	83	99	103
Gluyas Early ...	100	100	100	100	100	100	100	100
Geeralying	69	78*	...	...	89	79*	106	...
Gluyas Early ...	100	100	100	100	100	100	100	100
Noongaar	103	90	111	83	95	90	107	89

* Two years average.

Rate of Seeding Trials.

The averages for three years indicate that for late planting with early, and hence sparsely stooling varieties, 45lbs. of seed per acre give the best results. While a slight increase in the yield has been noted in the 60lbs. per acre plots, this year more so than in previous years, the increase is not large enough to give a sufficient margin over and above the extra 15lbs. of seed applied. The reason for the slight increase in yield from the heavily seeded plots, particularly in 1929, was on account of the very poor stooling which was noted, and hence these plots produced more plants per acre.

Wheat Variety Trials.

As previously stated, the purpose of these trials was to test the suitability of several early and very early wheats for late planting, comparing them with the standard Early Variety, Gluyas Early, planted at the same time. The results show a marked uniformity on the forest land at Goomarin,

Welbungin, and Lake Brown. At these places, over the period of the trials, Gluyas Early has given the best results, the varieties S.H.J. and Geeralying being particularly inferior. Noongaar yielded better than these two wheats, but on the average not so well as the control Gluyas Early. Noongaar showed to advantage in 1929 when the growing period was shortened by the absence of finishing rains.

On the lighter class of country at Mr. Hopwood's, Bencubbin, both Geeralying and S.H.J. have yielded better than on the heavier forest land at the other centres. It must be remembered too that the trials at this centre were the first planted each year. In 1929 Noongaar yielded the best, but over the average has not done as well as Gluyas Early.

The results confirm the following seeding calendar recommended by the Department for these areas:—

Forest Country—

Nabawa.—April 21st to May 7th.
Gluyas Early.—May 7th to May 31st
Noongar—May 21st to May 31st.
Commence fallowing June 1st.

Lighter classes of soil—

Nabawa.—April 14th to May 7th.
Gluyas Early, S.H.J.—May 1st to May 21st.
Geeralying.—May 14th to May 21st.
Noongaar.—May 21st to May 31st.
Commence fallowing 1st June.

Experiments with Oats.

Of the two variety trials with oats conducted during 1929, results are available only from Bencubbin (Mr. B. W. G. Hopwood). The yields, which are for 1929 only, are as follows:—

OAT VARIETY TRIAL

B W G HOPWOOD, BENCUBBIN

Planted 16th April, 1929 Seed—38lbs per acre. Superphosphate—112lbs per acre.

Plot	Variety	Section 1	Section 2	Average, 1929	
		Yield per acre.	Yield per acre	Yield per acre.	Per cent.
		bus lbs	bus lbs.	bus lbs	
1	Mulga	20 6	21 0	20 23	130
2	Burts Early	15 24	16 6	15 35	100
3	Guyra	18 18	17 32	18 5	114

These results, which are for one year only, confirm those obtained at the experiment farms and experience elsewhere that Mulga and Guyra are both very suitable varieties for this district. For a dual purpose oat Mulga is the best variety, Guyra being better for grain than hay.

For hay, Mulga may be planted with safety early in April, and for grain, Guyra about the same time as advised for Nabawa, and Mulga the same as Gluyas Early.

Demonstration Plots with Fodders at Bencubbin.

The opening of the district water scheme and with its consequence, the advent of more sheep in the area, made these demonstration plots a centre of considerable interest to local farmers. The following fodders were tested:—

Leguminous fodders—

- Field peas—two varieties.
- Lupins—four varieties.
- Lucerne.
- Subterranean Clover—very early variety.
- Horse beans.
- Vetch.

Miscellaneous fodders—

- Wimmera Rye Grass.
- Rape.
- Oats in buffers.

The season was such as to render most of these fodder plants failures or partial failures. This was valuable information because, in a district where fairly dry conditions are likely to prevail towards the end of the growing period, it showed it was not safe to sow these fodders on a large scale.

The following observations were recorded:—

Failures—Lucerne, subterranean clover, horse beans, vetches, and the three imported varieties of lupins.

Partial failures—Field peas, blue lupins, rape.

Promising—Wimmera rye grass.

Notes on Growth.

Field Peas.—Fairly good germination. Suffered from lack of finishing rains. The white variety matured about three weeks earlier than the Dunne's.

Lupins (W.A. variety).—Germinated fairly well. Only grew about a foot in height. Not affected by early frosts, but suffered badly from them during flowering. Made little pod and these were attacked by grubs.

Rape.—Poor germination. Did very well considering season. Should do fairly well when sown early and in seasons of early rains.

Wimmera Rye Grass.—Germination very good and grew very well considering the season. Average height above ground 9 inches, with stems quite 2 feet long. Stooled splendidly. This was the most promising fodder and remained green until December. An early strain would be an advantage. The herbage was relished by the sheep.

FARMERS' FIELD TRIALS IN THE CORRIGIN DISTRICT.

Two wheat variety tests were conducted in this area, on the heavy forest land at Mr. J. B. Taylor's, Kunjin, and on scrub plain on the property of Mr. J. B. Ding.

The object of the trial at Mr. J. B. Taylor's was to test early wheats suitable for planting in old paddocks where weeds are expected to be troublesome. The area of suitable land available was limited, and the trial was confined to three varieties. Midseason and late wheats were tested on the scrub plain as these wheats enable early planting, which is desirable on light land.

The rainfall recorded up to the end of the growing period was as follows:—

—	Jan.	Feb	Mar	Apl	Useful rains May.	June.	July.	Aug.	Sept.	Oct.	Total May-Oct.	Total Jan to Oct.
Kunjin	37	26	93	21	323	430	197	106	70	23	1,149	1,326
Corrigin	28	24	133	13	243	412	168	103	36	28	990	1,188

Variety Trial of Forest Land.

This land, which originally carried salmon gum, gimlet and wandoo, has been farmed for many years. It was fallowed with a mouldboard plow 4 inches deep in July, 1928. It was harrowed in September, tandem disced in October, and the northern half cultivated with a springtyne cultivator in April, and the whole are was springtyne cultivated and harrowed prior to seeding, which took place on May 15th.

The results are shown in the following table:—

WHEAT VARIETY TRIAL.

J. B. TAYLOR, KUNJIN.

Planted 15th May, 1929. Seed—48lbs. per acre. Superphosphate—118lbs per acre

Plot.	Variety.	Average Yield acre.		Per cent.
		bus.	lbs.	
1	Gluyas Early	23	47	117
2	Gresley	20	23	100
3	Carrabin	18	48	91

The plots were each half an acre in area and were duplicated, but were not harvested separately.

The results, which are for one year only, confirm the results obtained at the Experiment Farms and elsewhere, that Gluyas Early is a better yielder than the other two varieties. This variety, incidentally, has won the Corrigin Agricultural Society's Crop Competition during the past two years. Like Gresley, it is susceptible to flag smut, whereas Carrabin is resistant.

Carrabin is also a premium wheat and is a better yielder than the other varieties of wheats in this class. It stands up well, but is rather hard to thresh. Although Gluyas Early has a weak straw and is inclined to lodge, it has a very clean straw and is fairly easily handled.

Variety Trial on Scrub Plain.

The site selected for this trial was virgin scrub plain which was fallowed with a disc plough to a depth of 4 to 5 inches in July, 1928, and was tandem disced a week prior to seeding. The land had a slope towards the east and the varieties on upper portion were slightly more exposed than those lower down, and suffered most from the hot winds in September.

All the Nabawa and Yandilla King plots were sown before heavy rain which fell on 2nd May, which necessitated a further cultivation before the other plots were planted on 4th. The land was in a much better condition after this extra working and therefore it is not surprising that those varieties planted after the rain yielded better.

The results obtained are shown in the following table:—

WHEAT VARIETY TRIAL ON SCRUB PLAIN.

J. B. DING, CORRIGIN.

Planted 1st and 4th May, 1929. Seed—45lbs. per acre. Superphosphate—130lbs. per acre.

Plot.	Variety.	Section 1.	Section 2.	Average, 1929.	
		Yield per acre.	Yield per acre.	Yield per acre.	Per cent.
		bus. lbs.	bus. lbs.	bus. lbs.	
1	Bena	9 28	7 40	8 34	157
2	Nabawa *	5 10	5 46	5 28	100
3	Yandilla King *	5 42	8 14	6 58	·127
4	Ford	8 18	10 40	9 29	109
5	Nabawa	6 46	10 36	8 41	100
6	Federation	11 22	11 0	11 11	129

* Nabawa and Yandilla King both sown dry.

Neither Nabawa nor Yandilla King yielded as well as the other wheats which were sown after rain. On account of the difference in the working prior to seeding, the results are inconclusive.

FARMERS' FIELD TRIALS WITH WHEAT AND OATS.

1929.

L. SHIER, B.Sc. (Agric.),
Agricultural Adviser.

WHEAT TRIALS.

Field Trials with wheat in the Northern Wheat Belt were conducted on the properties of—

(a) N. G. Wright, Balla.

(b) Wandalong Estate, Dartmoor.

(c) Odgers & Murphy, East Tardun.

The properties on which these trials were conducted are situated along the fringe of the Northern Wheat Belt, and the object of the trials was to ascertain the most suitable early varieties of wheat for planting in these areas during the latter part of May.

Although contrary to the usual practice the trials were conducted in each instance on unfallowed land, fallowed land not being available.

Balla (N. G. Wright).

The land on this property on which the trials were conducted was a medium red loam, originally timbered with Yorrel and scrub. It had not been previously cropped, and was not fallowed for the experiments.

The official rains recorded for the 1st May-31st October period are as follows:—

——	Jan.	Feb.	Mch.	Apl.	May.	June.	July.	Aug.	Sept.	Oct.	Total usefu rain—May-Oct.
Balla ...	...	140	20	8	413	310	90	153	27	24	1,020

Good falls were recorded during May and June, and an even and vigorous germination resulted. The July rains, although scanty, were more plentiful than those of East Tardun and Dartmoor for the same month, and were followed by more appreciable falls in August, September and October.

The five varieties "Noongaar," "Gluyas Early," "S.H.J.," "Merredin" and "Geeralying" were planted on 31st May, with a disc drill, at the rate of 45 lbs. per acre. Superphosphate (22 per cent.) was applied at the rate of 90 lbs. per acre.

The crops, which matured in October, were not harvested till 25th November. Despite this there were no material signs of shedding or lodging in any of the varieties.

The average acre yields and the average acre yields per inch of rain during the growing period are tabulated below:—

—	Rainfall growing period	Noongaar.		Merredin		Geeralying.		Gluyas Early		S.H.J.	
		Avge. Yield per acre.	Bushels per inch.	Avge Yield per acre.	Bushels per inch.	Avge. Yield per acre	Bushels per inch	Avge. Yield per acre.	Bushels per inch	Avge. Yield per acre	Bushels per inch.
	inches	bus. lb.	bus lb	bus lb	bus. lb.	bus lb.	bus lb.	bus lb	bus lb.	bus lb	bus. lb.
Balla	10 20	21 39	2 7	19 54	1 57	19 22	1 54	19 0	1 52	18 55	1 51

It will be seen that the variety "Noongaar" gave the highest average yield per acre, followed by "Merredin," "Geeralying," "Gluyas Early" and "S.H.J." in that order.

East Tardun (Odgers & Murphy).

The soil was a medium to heavy red loam, originally carrying Yorrel and scrub. The plots were on new land which had not previously been cropped.

The varieties "Noongaar," "Gluyas Early," "S.H.J.," "Merredin" and "Geeralying" were planted on 19th May with a combine cultivator-drill. The seed was planted at the rate of 45 lbs. per acre, with an application of superphosphate of 90 lbs. per acre.

The rainfall officially recorded to the end of October is shown in the accompanying table:—

—	Jan.	Feb	Mch	Apl.	May.	June.	July	Aug	Sept.	Oct.	Total useful rain—May–Oct.
East Tardun...	6	262	37	4	267	235	68	79	3	6	658

May and June were the only months in which good rains were recorded, and, although very light falls were recorded for July and August, those of September and October are not worthy of consideration.

The results of the trials are tabulated below:—

—	Rainfall growing period.	Noongaar.		Gluyas Early.		Merredin.		Geeralying.		S.H.J.	
		Avge. Yield per acre.	Bushels per inch.	Avge. Yield per acre.	Bushels per inch.	Avge. Yield per acre.	Bushels per inch.	Avge. Yield per acre.	Bushels per inch.	Avge. Yield per acre.	Bushels per inch.
	inches.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
East Tardun	6·58	18 15	2 47	17 40	2 41	17 34	2 40	16 7	2 27	15 30	2 21

These results show "Noongaar" to be the most prolific variety, closely followed by "Gluyas Early" and "Merredin." The yields from these three varieties, stated as bushels per inch of growing period rainfall, are particularly good, ranging from 2 bushels 40 lbs. to 2 bushels 47 lbs.

Wandalong Estate, Dartmoor.

The land, which was of the medium red loam type, had originally carried Yorrel and scrub.

The official rainfall figures recorded to the end of October are shown in the following table:—

-	Jan	Feb	Mar	Apl	May	June	July	Aug	Sept	Oct	Total useful rain May-Oct
Dartmoor	109	265	7		267	205	48	87	8	10	635

The rainfall was not quite as plentiful as at East Tardun, but its distribution was the same, good falls being recorded only during the months of May and June, September and October being practically lacking in this respect.

The land was cropped in 1928, and the stubble had been burnt immediately prior to being prepared for the trial. Ploughing operations were carried out in April, 1929. The plots were seeded on 19th May with a combine cultivator-drill, each of the five varieties "Noongaar," "Gluyas Early," "S.H.J.," "Merredin" and "Geeralying" being planted at the rate of 45 lbs. per acre. Superphosphate was applied at the rate of 90 lbs. per acre.

The variety "Noongaar" was harvested on 17th October, and the remaining varieties on 23rd October, 1929.

The yields from the plots are as follows:—

—	Rainfall growing period.	Noongaar.		Merredin.		Geeralying.		Gluyas Early.		S.H.J.	
		Avge. Yield per acre.	Bushels per inch.	Avge. Yield per acre.	Bushels per inch.	Avge. Yield per acre.	Bushels per inch.	Avge. Yield per acre.	Bushels per inch.	Avge Yield per acre.	Bushels per inch.
	inches.	bus. lb.	bus. lb	bus. lb	bus. lb.	bus. lb	bus. lb	bus. lb.	bus. lb	bus. lb.	bus. lb.
Dartmoor	6·35	17 12	2 43	17 10	2 42	16 20	2 34	16 19	2 34	15 46	2 29

Here the varieties "Noongaar" and "Merredin" were the most prolific. The yields from "Geeralying" and "Merredin" were almost a bushel per acre less, whilst "S.H.J." yielded 1½ bushels per acre less.

The table below gives the results of the three trials in summarised form to make comparisons of the different varieties:—

——	Rainfall during growing period.	Noongaar. Avge. Yield per acre.	Noongaar. Bush. per acre per G.P. Rain.	Merredin. Avge. Yield per acre.	Merredin. Bush. per acre per inch. G.P. Rain.	Gluyas Early. Avge. Yield per acre	Gluyas Early. Bush-per acre per inch. G.P. Rain.	Geeralying. Avge. Yield per acre.	Geeralying. Bush-per acre per inch. G.P. Rain.	S.H.J. Avge. Yield per acre.	S.H.J. Bush-per acre per inch. G.P. Rain.
	points.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Balla ...	1,020	21 39	2 7	19 6	1 52	18 55	1 51	19 54	1 57	19 22	1 54
East Tardun	658	18 58	2 47	17 40	2 41	15 30	2 21	17 34	2 40	16 7	2 27
Dartmoor	635	17 12	2 43	16 19	2 34	15 46	2 29	17 10	2 42	16 20	2 34
Variety averages	Noongaar: bus. lb. 19 2		Merredin: bus. lb. 18 13		Gluyas Early: bus. lb. 17 42		Geeraling: bus. lb. 17 16		S.H.J.: bus. lb. 16 44		

From this table it will be seen that "Noongaar" is the most prolific variety in each instance, and of the five varieties sown seems to be the one most suited for late planting in these areas. At Balla and East Tardun the variety "Merredin" showed to advantage. At Dartmoor, however, the variety "Geeralying" did considerably better than it, whilst from "S.H.J." an equal yield was obtained. However, taking the general average from the three centres the varieties yielded in the order "Noongaar," "Merredin," "Gluyas Early," "Geeralying" and "S.H.J."

Another interesting feature of the trials is shown in the following table. At East Tardun and Dartmoor the growing period rainfall was not more than 6½ inches, but despite this, yields of 2 bushels 36 lbs. per acre per inch of rain were obtained, while at Balla, with a little more than 10 inches of rain during the growing period, the average per inch of useful rain was just below 2 bushels:—

AVERAGE YIELD OF ALL PLOTS.

——	Yield per acre.		Yield per acre per inch G.P. rainfall.	
	bus.	lbs.	bus.	lbs.
Balla	19	40	1	56
East Tardun	17	8	2	36
Dartmoor	16	31	2	36

OAT TRIALS.

A variety trial with oats was carried out with three varieties on the property of Mr. J. K. Forrester, at Carnamah.

The land on which the trials were planted had originally been timbered with heavy ti-tree scrub running into york gum at one end. The soil was of

a red loamy nature, and had been ploughed four inches deep with a mouldboard plough during August, 1928, and was cultivated with a springtyne implement in October.

The seed was planted at the rate of 45 lbs. per acre, with an application of 120 lbs. of superphosphate (22 per cent.) per acre, on the 15th May with a combined cultivator-drill. Each variety was planted in duplicate and each plot was half an acre in area.

The rainfall for 1929, together with the average for the past 38 years, is hereunder:—

Year.	Jan.	Feb.	Mar.	Apl.	Useful Rains. May	June.	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
1929 ...	26	113	22	8	352	425	214	121	35	24	1,171	118	...	1,458
Av. 38 yrs.	45	64	79	70	214	324	282	223	136	70	1,249	35	35	1,577

The plots were harvested for grain on the 28th October; the results obtained are set out below:—

Variety.	Yields per Acre. Plot No.	Average. bus.	lbs.	Plot No.	Average. bus.	lbs.	Average. bus.	lbs.
Guyra	1	35	14	4	31	16	33	15
Burt's Early	2	30	38	5	31	18	31	8
Mulga	3	31	14	6	32	38	32	6

Good yields were obtained from all three varieties, and, although the results are for one year only, they indicate that these varieties are suitable for this area.

FIELD EXPERIMENTS WITH WHEAT, 1929.

MERREDIN EXPERIMENT FARM.

I. THOMAS, Supt. of Wheat Farms,
and
J. H. LANGFIELD, Manager.

The following field experiments were conducted with wheat at the Merredin Experiment Farm during 1929 in addition to those published in the March issue of the "Journal of Agriculture":—

Depth of Ploughing Experiment.
Mulching Experiment.
Fallow v. Non-Fallow Experiment.
Early v. Late Fallow Experiment.

The monthly rainfall recorded at the farm for 1929, together with the average for the past 17 years, is as under:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.						Total Useful Rain.	Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.				
1929 ...	50	162	27	...	357	309	119	94	13	35	927	220	5	1,441
Av. 18 yrs.	58	59	116	73	135	186	191	137	94	77	820	46	55	...

The growing period rainfall for the year is some 1.07 inches above the average and might indicate that an exceptionally good season had been experienced. Closer observation shows that 6.66 inches fell during May and June and made seeding exceedingly difficult. August, September, and October, the critical months for wheat, recorded only 1.42 inches; September yielding only 13 points, registered in four falls, and therefore almost useless. Add to this the fact that 2.20 inches fell in November, *i.e.*, after the crops were mature, and therefore of no benefit.

The experiments were conducted on a rich clay loam typical of salmon gum and gimlet country.

Depth of Ploughing Experiment.

This experiment has been conducted for the past 15 years (commenced 1915), and its object is to determine the comparative effects upon resultant crops of ploughing land to different depths.

The three plots used for the experiment were ploughed as follows:—

Plot No. 1—4 inches, representing shallow ploughing.
Plot No. 2—6 inches, representing medium ploughing.
Plot No. 3—8 inches, representing deep ploughing.

Each plot contained one-eight of an acre, and was repeated five times, all being harvested for grain.

The plots were ploughed to their respective depths in July, 1928, with a disc plough. They were springtyne cultivated in September, harrowed after 1½ inches of rain on February 15th, and cultivated with a springtyne implement in early April and again before planting.

The variety "Nabawa" was planted on May 1st at the rate of 45 lbs. seed per acre with an application of 120 lbs. of superphosphate (22 per cent.). On May 8th the plots were harrowed.

The results obtained last year, together with the average results for the past 15 years, are tabulated below:—

DEPTH OF PLOUGHING EXPERIMENT, 1929

Variety Nabawa Planted on 1st May Superphosphate (22%) 120lbs. per acre.
Seed, 45lbs. per acre

Depth of Ploughing	Computed Yields per Acre					Average Yields per acre 1929.	Percentage Yields 1929	Average Yields per acre, 1915–29	Percentage Yields 1915-29.
	Sec. 1.	Sec 2.	Sec. 3.	Sec 4	Sec 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb		bus. lb.	
4in.	22 32	21 49	26 4	23 45	23 75	24 3	104	23 44	103
6ins.	21 34	22 47	23 16	24 7	24 15	23 12	100	22 56	100
8ins	21 49	23 16	24 7	24 36	21 27	23 3	99	22 56	100

These results are consistent with those of the past 15 years and show that there is no advantage to be gained by ploughing to a greater depth than four inches.

Mulching Experiment.

The object of this experiment is to determine how far and under what conditions the cultivation of winter-fallowed land is profitable during the spring and summer months.

The land on which the experiments were conducted was ploughed in June, 1928, to a depth of four inches with a disc plough. Subsequent cultivations were carried out according to the requirements of the experiment. Three plots were necessary and were treated as follows:—

Plot 1. *Well-worked Fallow.*—Cultivated during spring, again when required during summer after a fall of rain of 25 points or over, and again prior to seeding, the object being to maintain a mulch throughout the fallowed period and to destroy weed growth.

Plot 2. *Ordinary Fallow.*—Cultivated during spring and prior to seeding only.

Plot 3. *Neglected Fallow.*—Cultivated just prior to seeding only.

Sheep were depastured on the plots after ploughing.

The plots were each one-eighth of an acre in area and were repeated five times, all being eventually harvested for grain.

All plots received cultivations with a springtyne implement at the end of April and before planting, and were harrowed after planting.

The experiment was planted on the 8th May with the variety "Nabawa" sown at the rate of 45 lbs. per acre with superphosphate (22 per cent.) at the rate of 120 lbs. per acre.

The results for 1929, together with the results of the past 13 years, are set out hereunder:—

MULCHING EXPERIMENT, 1929.

Variety—Nabawa. Planted on 8th May. Superphosphate (22%) 120lbs. per acre.

Seed, 45lbs. per acre.

Treatment.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1929.	Percentage Yields 1929.	Average Yields per acre, 1915–29.	Percentage Yields, 1915–29.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
Mulched in spring after rain during summer and before planting. (Well worked Fallow)	23 38	21 49	21 34	22 32	21 12	22 9	99	22 36	102
Mulched in spring and before planting only. (Ordinary Fallow)	19 44	22 3	24 36	23 38	22 10	22 26	100	22 8	100
Mulched before planting only. (Neglected Fallow)	20 6	20 6	24 51	22 18	16 34	20 47	93	20 56	95

This year's results show very little difference in yield between the continuously cultivated plots (well-worked fallow) and the plots cultivated only in the spring and prior to seeding (ordinary fallow), but both these show an increase over the plots ploughed in the previous winter and mulched before planting only (neglected fallow). This confirms the average results of the past 13 years during which time the experiment has been conducted continuously. It also shows and confirms previous years' results in that the yields of the wheat crop are decreased when land ploughed the previous winter receives no further attention until seeding time.

Fallow v. Non-Fallow Experiment.

This experiment was conducted to show the practical and economic advantages, if any, of fallowing in heavy types of soil.

Five plots of one-quarter acre area were used, three of these being fallowed and two unfallowed. The three fallowed plots were ploughed to a depth of four inches with a disc implement in June, 1928, cultivated with a springtyne cultivator in September, harrowed after 1½ inches of rain in February, springtyne cultivated in April, and twice cultivated before seeding. The two unfallowed plots were disc-ploughed to a depth of four inches in early May, 1929, and springtyne-cultivated twice before seeding.

The variety "Gluyas Early" was planted in all five plots on May 23rd at the rate of 45 lbs. per acre, and superphosphate (22 per cent.) was applied at the rate of 120 lbs. per acre.

The results were as follows:—

FALLOW v. NON-FALLOW EXPERIMENT, 1929.

Variety—Gluyas Early. Planted on 23rd May. Superphosphate (22%)—120lbs. per acre. Seed, 45lbs. per acre.

Treatment.	Computed Yields per Acre.					Average Yields per acre, 1929.	Percentage Yields, 1929.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	
Fallowed	24 7	...	24 3	...	18 30	22 13	100
Unfallowed ...	...	18 4	...	14 8	...	16 6	73

Little observation is required to note the improved yields from the fallowed plots. The difference in yield definitely indicates the economic advantages of fallow, for in these plots increased yield of some 6 bushels 7 lb. per acre was the direct result of fallowing.

Briefly some of the advantages of fallowing are.—

1. Permits of seeding at the correct time.
2. A better chance is afforded for the destruction of weeds.
3. More moisture is conserved in normal years, thus providing a better insurance against dry spells at critical periods.
4. Fallowing renders it possible to work the soil down to an even tilth, resulting in an even and strong germination.
5. Stimulates the production of nitrates, sweetens and aerates the soil.
6. Observations show that fallowing helps to check "Takeall" and other fungus diseases.
7. Increased yields.

Early v. Late Fallowing Experiment.

This experiment has been conducted for the past six years with the object of determining the effects, if any, between early and late winter fallowing on resultant wheat crops grown on heavy land.

Two plots, each of half an acre in area, were required, and the crop was harvested for grain. The early fallow plot was ploughed the first week in June, 1928, and the late fallow plot the third week in August, 1928. Both were ploughed with a disc plough to a depth of four inches and were subsequently cultivated in September with a springtyne cultivator; harrowed after rain in February, cultivated with a springtyne in April, and twice cultivated with the same implement immediately before planting.

On May 1st, 1929, the variety Nabawa was planted at the rate of 45 lgs. per acre with an application of 120 lbs. of 22 per cent. superphosphate per acre.

In the results tabulated below, the yields for 1929 are shown, together with the average for the past six years.

EARLY *v.* LATE FALLOW EXPERIMENT. 1929.

Planted 1st May, 1929. Variety—Nabawa. Superphosphate (22%)—120lbs. per acre. Seed—45lbs. per acre.

Date ploughed.	Computed Yields per acre. Section 1.	Computed Yields per acre. Section 2.	Average Yields per acre.	Percentage Yields.	Average Yields per acre, 6 years.	Percentage Yields, 6 years.
	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
1st week in June	16 36	...	16 36	100	23 4	100
3rd week in August	...	13 20	13 20	80	19 17	83

Heavy rains fell in May and June, after the plots were planted, and these favoured the late fallow by tending to equalise the moisture content of both early and late fallowed plots. Despite this fact, the early fallow shows to advantage in the results, not only last year, but during the whole six years the experiment has been conducted, and from this it can be concluded that when the land is fallowed early heavier yields are obtained.

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SALMON GUMS EXPERIMENT FARM.

FIELD EXPERIMENTS WITH WHEAT, 1929.

I. THOMAS, Supt. of Wheat Farms,
L. G. SENIOR, Manager.

Other than those published in the March, 1930, issue of this Journal, the following field experiments were conducted with wheat at the Salmon Gums Experiment Farm during 1929:—

Depth of Ploughing Experiment.
Time of Ploughing Experiment.
Mulching Experiment.

The monthly rainfall and the total for 1929 recorded at the farm are shown in the table below, together with the average for the past 11 years recorded at Salmon Gums, one mile distant from the farm:—

——	Jan.	Feb.	Mar.	Apl.	Growing period.						May to Oct.	Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.				
At Experiment Farm, 1929	106	65	73	26	125	207	159	163	21	35	710	150	43	1,173
Average, 11 years, Salmon Gums	31	50	112	106	154	152	135	131	115	126	813	81	81	1,273

The growing-period rain for 1929 is almost an inch below the eleven years' average. Sufficient rain fell in May and June for good germination, and the July and August recordings were above the average. However, only 21 points were recorded during September, and by the end of that month the crops were showing signs of distress, and eventually did not yield up to earlier expectations.

The land on which the experiments were planted was of the heavier mallee type.

Depth of Ploughing, 1929.

This experiment, which was conducted this year on red loam cleared in 1926 and first cropped in 1927, has for its object the ascertaining the most economical depth to plough for the wheat crop.

Three plots (each replicated five times) were required, one ploughed to a depth of two inches, one to four inches, and one to five inches. It was intended to plough the last-mentioned plot to a depth of six inches, but the condition of the land did not permit of this being done.

All the plots were ploughed to their respective depths in June, 1928, and cross-ploughed in September-October of that year to kill self-sown wheat plants. In January, 1929, all the plots were cultivated with a spring-tyne implement, and this operation was repeated ahead of the drill.

The 2-inch plots had a tendency to set and become hard more readily than either of the other two, making it more difficult to obtain a suitable seed bed.

On 13th May, 1929, the variety "Nabawa" was planted at the rate of 45 lbs. per acre. Superphosphate (22 per cent.) was applied at the rate of 112 lbs. per acre. The lack of rain during September and October seriously affected the results of all crops.

The results of the experiment are given in table form below:—

DEPTH OF PLOUGHING EXPERIMENT. 1929.

Variety—Nabawa. Planted on 13th May, 1929. Superphosphate (22%)—112lbs. per acre. Seed—45lbs. per acre.

Depth of Ploughing.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per Acre, 1929.	Percentage Yields, 1929.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
2 inches	12 47	13 24	13 46	13 9	13 24	13 18	94
4 inches	13 46	14 0	14 51	13 46	14 22	14 9	100
5 inches	12 18	14 0	13 24	14 8	11 56	13 9	93

From these results, and in view of the difficulty in maintaining the soil in a suitable condition, it would appear that 4 inches is the most suitable and economical depth to plough, but as the results are for one year only, a definite conclusion cannot be arrived at.

Time of Ploughing Experiment.

This experiment is conducted with the object of determining to what extent the time of ploughing (fallowing) affects a resultant wheat crop.

The land on which the experiment was conducted this year was originally timbered with Silverbark and Mallee. Three plots, treated in the following manner, were required:—

Plot 1. Ploughed in March, 1928. (Long Summer Fallow)
Plot 2. Ploughed in June, 1928. (Early Winter Fallow.)
Plot 3. Ploughed in September. (Late Winter Fallow.)

Each plot was repeated five times, and harvested for grain.

With the exception of the time of the initial operation (ploughing), all plots were treated alike. They were cross-disc cultivated in October to destroy self-sown wheat plants, and in January they were cultivated with a springtyne implement. They were again cultivated before seeding.

The variety Nabawa was planted on the 14th May, 1929, at the rate of 45 lbs. per acre. Superphosphate (22 per cent.) was applied at the rate of 112 lbs. per acre.

TIME OF PLOUGHING EXPERIMENT, 1929.

Variety—Nabawa. Planted on 14th May. Superphosphate (22%)—112lbs. per acre. Seed—45lbs. per acre.

Time of Ploughing.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1929.	Percentage Yields, 1929.	Average Yields per acre, 1928-29.	Percentage Yields, 1928-29
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
Ploughed in March	9 45	10 48	10 58	10 58	11 56	10 52	95	13 22	93
Ploughed in June	11 12	11 27	11 5	11 20	12 4	11 26	100	13 39	100
Ploughed in September	10 7	10 21	10 36	11 5	11 5	10 39	93	12 43	92

These results are in favour of the June fallowing, indicating that, where possible in this district, the initial operation of ploughing should be carried out immediately after seeding. Difficulty was experienced with March ploughing as a result of the dry spring and summer months. Apart from this, it is difficult to understand why the results from the plots ploughed in March did not equal those plots ploughed in June.

Mulching Experiment, 1929.

This experiment is planned to show the advantage, if any, of working winter-fallowed land during the spring and summer months.

For this purpose three plots were required, and are designated "Well-worked Fallow," "Ordinary Fallow" (Control), and "Neglected Fallow." They were one-eighth acre in area, and were as follows:—

1. *Well-worked Fallow.*—Cultivated during spring, again when required during summer after 25 points of rain or over, and again before seeding, the object being to maintain a mulch during the fallowed period and to destroy weed growth. The dates of the various cultural operations were as follow: ploughed June, 1928; cultivated October, 1928, January, 1929, 22nd February, 20th March, and again ahead of the drill.

2. *Ordinary Fallow.*—Cultivated during spring and prior to seeding only. Date of cultural operations: ploughed June, 1928, cultivated 23rd October, 1929, and again ahead of drill.

3. *Neglected Fallow.*—Ploughed in June, 1928, and cultivated immediately prior to seeding.

Each plot was repeated five times, and all were situated on red loamy soil. The land, previous to being cleared, was timbered with Silverbark and Mallee.

The variety "Nabawa" was planted on the 15th May, 1929, at the rate of 45 lbs. per acre. Superphosphate (22 per cent.) was applied at the rate of 112 lbs. per acre.

The results are tabulated below:—

MULCHING EXPERIMENT, 1929.

Variety—Nabawa. Planted on 15th May. Superphosphate (22%)—112lbs. per acre
Seed—45lbs. per acre.

Treatment.	Computed Yields per acre. Sec. 1.	Sec. 2.	Sec. 3	Sec. 4.	Sec. 5.	Average Yields per acre, 1929.	Percentage Yields, 1929.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	
Mulched in spring, after rains during summer and before seeding	14 15	14 30	14 30	13 53	13 46	14 11	104
Mulched in spring and before seeding (Control)	13 53	14 59	13 17	13 9	12 56	13 39	100
Mulched before seeding only	14 37	15 7	14 0	13 31	13 2	14 3	103

This is the first year this experiment has been conducted at this farm, and therefore no definite conclusions can be arrived at.

FIELD EXPERIMENTS WITH WHEAT, 1929.

YILGARN EXPERIMENT FARM.

I. THOMAS,
Superintendent of Wheat Farms, and

G. K. STEVENS,
Farm Manager.

The following experiments, in addition to those published in the March issue of the Journal, were conducted at the Yilgarn Experiment Farm last year:—

Depth of Ploughing Experiment.
Time of Ploughing Experiment.
Mulching Experiment.

The monthly rainfalls, as recorded at the Farm for 1929 and 1928, together with the average for the past 40 years, as officially recorded at Southern Cross, eight miles west of the Farm, are set out below—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.						Total, May-Oct.	Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.				
1929 ...	36	120	50	...	275	145	57	25	9	60	571	294	...	1,071
1928 ...	92	...	62	50	170	76	165	89	48	7	555	...	57	816
Av. 40 yrs.	50	59	106	72	194	139	144	107	79	63	726	50	46	1,051

From these records, it will be seen that, except for the excellent rains which were experienced during the months of May and June, resulting in a good even germination, the crops were grown under extremely adverse climatic conditions.

Depth of Ploughing Experiment.

The object of this experiment is to determine the comparative effect upon resulting wheat crops of ploughing the land to different depths. For the purpose of this experiment three plots (each replicated five times), were required, and were ploughed to depths of two inches, 4 inches and six inches respectively.

Previous to being cleared in 1928 the land was timbered with Salmon Gum and Gimlet. For this year's experiment the plots were ploughed in June, 1928. All plots were cultivated with a Springtyne implement in September, January, February and again immediately prior to seeding. On each occasion the "two-inch deep" plots received additional cultivation in order to break the hard surface and obtain a mulch. At seeding time several cultivations were necessary to bring these plots into the desired tilth.

The variety "Gluyas Early" was planted on the 13th May at the rate of 42 lbs. per acre with an application of 112 lbs. of superphosphate (22 per cent.), per acre.

The results are as under:—

DEPTH OF PLOUGHING EXPERIMENT, 1929.

Variety—Gluyas Early. Superphosphate (22%)—112lbs. per acre. Planted on 11th May. Seed—42lbs. per acre.

Depth of Ploughing.	Computed Yields per Acre.					Average Yields per acre, 1929.	Percentage Yields, 1929.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
2 inches	7 41	6 27	5 14	7 41	9 45	7 22	82
4 inches	9 1	6 49	*	8 46	11 20	8 59	100
6 inches	8 46	7 19	7 55	8 10	9 52	8 24	93

* Discarded owing to accident at seeding time.

As the results are for the one year only, no definite conclusion can be arrived at, but, in view of the difficulty experienced in maintaining the mulch during the fallowed period, these results indicate that the deeper ploughing is advisable.

Time of Ploughing Experiment.

The object of this experiment is to determine whether the time of ploughing has any effect on the resultant wheat crop on heavy land.

This is the first year the experiment has been conducted on this farm, and the land on which the plots were situated was of the heavy Salmon Gum and Gimlet type.

Three plots were required, and, as except for the initial ploughing operation, all three were treated in a similar manner. One plot was ploughed in March, 1928, one in June and one in August, 1928. Subsequent cultivation took place during September, January, February and before seeding on all plots. Each plot was replicated five times.

The results are as set out below:—

TIME OF PLOUGHING EXPERIMENT, 1929.

Variety—Gluyas Early. Planted on 13th May, 1929. Superphosphate (22%)—112lbs. per acre. Seed—42lbs. per acre.

Treatment.	Computed Yields per Acre.					Average Yelds per Acre.	Percentag Yields.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
Ploughed March 15th, 1928	bus. lbs. 10 7	bus. lbs. 7 26	bus. lbs. 7 55	bus. lbs. 7 41	bus. lbs. 9 45	bus. lbs. 8 35	% 90
Ploughed June 15th, 1928	11 27	9 8	9 23	7 33	9 59	9 30	100
Ploughed August 15th, 1928	[illegible] 38	5 14	7 33	7 26	6 27	7 16	76

The results are for one year only, and no definite conclusion can be arrived at. However, they confirm the results of a similar experiment conducted at the Chapman and Salmon Gums Experiment Farms last season.

Mulching Experiment.

The object of this experiment is to determine how far and under what conditions the cultivation of winter-fallowed land is profitable during the spring and summer months. The land on which the experiment was conducted was ploughed with a disc implement in June, 1928.

Three plots were necessary and to meet the requirements of the experiment, they were treated as follows:—

Plot No. 1—*Well worked Fallow.*—Cultivated during spring, again when required during summer, after 25 points of rain or over, and again prior to seeding, the object being to maintain a mulch throughout the fallowed period and to destroy weed growth.

Plot No. 2—*Ordinary Fallow.*—Cultivated during spring and prior to seeding only.

Plot No. 3—*Neglected Fallow.*—Cultivated prior to seeding only.

The land on which the experiment was conducted this year was typical Salmon Gum and Gimlet timber country, and had not been previously cropped.

Plot No. 1 this year received cultivations with a Springtyne implement in September, January, February and March, and again before seeding; Plot No. 2 was cultivated in September and again before seeding, while Plot No. 3 was cultivated prior to seeding only.

The variety "Gluyas Early" was planted on 13th May, 1929, at the rate of 42 lbs. per acre; superphosphate (22 per cent.) was applied at the rate of 112 lbs. per acre.

Last year's results, and the average results for the two seasons that the experiment has been conducted, are set out below:—

MULCHING EXPERIMENT, 1929.

Variety—Gluyas Early. Planted on 11th May. Superphosphate (22%)—112lbs. per acre. Seed—42lbs. per acre.

Treatment.	Computed Yields per Acre.					Average Yields per acre, 1929.	Percentage Yields, 1929.	Average Yields per acre, 1928-29.	Percentage Yields. 1928-29.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
Mulched in spring, after rains during summer, and before seeding	10 43	9 38	9 45	11 34	10 36	10 27	109	16 18	109
Mulched in spring and before seeding (Control)	9 8	9 23	9 23	10 29	9 45	9 38	100	15 2	100
Mulched before seeding only	7 48	8 39	8 54	9 45	9 45	8 58	93	15 2	100

This year's results, and the average results for the two years the experiments have been conducted, indicate that greater yields are obtained when the fallow is cultivated during the spring and during the summer months should appreciable falls of rain occur.

FIELD EXPERIMENTS WITH WHEAT.

CHAPMAN EXPERIMENT FARM.

I. THOMAS,
Superintendent of Wheat Farms.

P. JEFFREY,
Manager.

In addition to the experiments published in the March issue of this Journal, the following experiments were conducted during 1929 with wheat at the Chapman Experiment Farm:—

Depth of Ploughing Experiment.
Time of Ploughing Experiment.
Mulching Experiment.

The following table shows the monthly rainfall recorded at the Farm as well as the average for the previous 24 years.

Year.	Jan.	Feb.	Mar.	Apl.	Growing period.						Total, May-Oct.	Nov.	Dec.	Total, for Year.
					May.	June.	July.	Aug.	Sept.	Oct.				
1929 ...	...	40	20	10	424	643	189	190	73	35	1,554	106	3	1,733
* Previous 24 years average	28	48	65	43	238	418	397	268	164	96	1,581	29	23	1,817

* This average as appeared in the March issue was incorrect.

The seasonal rains commenced early in May and during that and the following month the rainfall was considerably above the average for that period. The rainfall for the remaining months of the growing period, however, although below the average, was sufficient for the crop to mature normally on account of the previous excessive rain.

Depth of Ploughing Experiment.

This experiment was conducted on land ploughed to the respective depths in August, 1928, springtyne cultivated in September and October and again prior to seeding.

It is designed to determine the comparative effects upon the crop when the land is ploughed to different depths. Three plots were required and were ploughed as follows:—

Plot 1.—4 inches, representing shallow ploughing.
Plot 2.—6 inches, representing medium ploughing.
Plot 3.—8 inches, representing deep ploughing.

The plots were each an eighth of an acre in area and were repeated five times.

The land on which the experiment was conducted this year was cleared of wattle and jam timber some years previously. Heavy rainfall during May and June caused waterlogging and growth was retarded.

The results obtained this year, together with the average results for the past 15 years are as follow:—

DEPTH OF PLOUGHING EXPERIMENT, 1929.

Variety—Nabawa. Planted on 9th May, 1929. Superphosphate (22%)—112lbs. per acre. Seed—45lbs. per acre.

Depth of Ploughing.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1929.	Percentage Yields, 1929.	Average Yields, per acre, 1915-29.	Percentage Yields, 1915-29.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
Ploughed 4in. deep	12 55	12 47	14 37	11 27	14 15	13 12	88	16 16	100
Ploughed 6in. deep (Control)	14 37	14 15	14 59	15 50	15 36	15 3	100	16 16	100
Ploughed 8in. deep	13 24	15 57	15 21	13 31	15 57	14 50	99	16 59	104

The results for this year are in favour of the deeper ploughing. This was the case last year when the differences were not nearly so marked. However, the average results since 1915 (15 years), when the trial commenced, show very little difference, at the same time indicating that deeper ploughing, though not economical, does not decrease the yields of the wheat crop.

Time of Ploughing Experiment.

The experiment is being conducted in order to ascertain the comparative effects upon the wheat crop of long summer fallow, early winter fallow and late winter fallow.

For the purpose of the experiment three plots ploughed in March, June and August, were required. The plots were replicated five times.

Ploughing was carried out to a depth of four inches, the soil being a light sandy loam.

The plots ploughed in March were springtyne cultivated in June on account of weed growth. All plots were cultivated in August, September and prior to seeding in May.

TIME OF PLOUGHING EXPERIMENT, 1929.

Variety—Nabawa. Planted on 10th May. Superphosphate (22%)—112lbs. per acre. Seed—45lbs. per acre.

Time of Ploughing.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4	Sec. 5.	Average Yields per acre, 1929.	Percentage Yields, 1929,
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	
Ploughed March, 1928 (Summer fallow)	9 16	9 45	10 7	10 21	10 58	10 9	88
Ploughed June, 1928 (Control) (early winter fallow)	12 55	11 20	12 4	9 52	11 5	11 27	100
Ploughed August, 1928 (late winter fallow)	10 14	8 3	8 54	8 39	8 39	8 54	78

The results are for one year only and hence cannot be taken as conclusive. However they confirm the results of experiment elsewhere, indicating that early winter fallow is considerably better than late winter fallow.

Mulching Experiment.

The object of this experiment is to determine how far and under what conditions the cultivation of winter fallowed land is profitable during the spring and summer months.

The experiment has been conducted since 1914, and as in previous years the following system of cultivation was adopted.

Plot 1. (*Well Worked Fallow*).—Cultivated during spring, when required during summer, after 25 points of rain or over and again prior to seeding, the object being to maintain a mulch throughout the fallowed period and to destroy weed growth.

Plot 2. (*Ordinary Fallow—Control*).—Cultivated during spring and prior to seeding only.

Plot 3. (*Neglected Fallow*).—Cultivated prior to seeding only. The land was fallowed in July, 1928, and the plots were cultivated as mentioned above The well-worked fallow received four cultivations during the summer months.

The results for this year and the average results for 1914-1929 are as follow:—

MULCHING EXPERIMENT, 1929.

Variety—Nabawa Planted on 13th May, 1929. Superphosphate (22%)—112lbs. per acre Seed—45lbs. per acre.

Grain Yields.

Treatment.	Computed Yields per Acre.					Average Yields per acre.	Percentage Yields.	Average Yields per acre 1914-29.	Percentage Yields, 1914-29
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
Cultivated in spring after summer rains and before seeding	16 4	16 4	17 54	14 0	14 59	15 48	100	16 25	108
Cultivated in spring and before seeding (Control)	15 43	16 12	17 3	15 14	14 37	15 46	100	15 14	100
Cultivated before seeding only	14 51	16 56	16 19	15 29	14 0	15 31	98	13 51	91

Hay Yields

Treatment.	Computed Yields per Acre.			Average Yields per acre.	Percentage Yields.	Average Yields per acre, 1914-29.	Percentage Yields, 1914-29.
	Section 1.	Section 2.	Section 3.				
	C. Q. L.	C. Q. L.	C. Q. L.	C. Q. L.		C. Q. L.	
Cultivated in spring, after summer rains and before seeding	18 1 25	20 0 19	21 1 10	19 1 13	103	26 1 8	106
Cultivated in spring and before seeding (Control)	18 1 10	18 1 3	20 1 27	19 0 4	100	24 2 21	100
Cultivated before seeding only	18 1 3	17 3 15	19 3 25	18 2 24	97	21 0 3	85

Both the results of this year and the average results over the past 15 years are in favour of the plots cultivated in spring, after summer rains and before planting, though for this year the increase does not warrant the extra cost of so many cultivations.

FIELD EXPERIMENTS WITH WHEAT AND OATS, 1929.

AVONDALE STATE FARM.

A. S. WILD, B.Sc. (Agric.), Agricultural Adviser,
and
H. J. BAILEY, Farm Manager.

The land on which the wheat experiments were conducted was typical york gum and jam country which had been cleared a number of years. It had been ploughed during the previous July to a depth of four inches with a mouldboard plough, disced or springtyne cultivated during October according to the extent of the weed growth, springtyne cultivated in February, disced in April where necessary to destroy weeds, and again springtyne cultivated immediately prior to planting.

The monthly rainfalls as recorded at the farm, together with the average for the past 44 years as officially recorded at Beverley, four miles distant, are set out hereunder:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Avondale 1929.	...	109	77	15	256	434	228	123	73	36	1,150	198	7	1,556
Av. Beverley 44 years ...	31	44	64	85	220	319	326	246	166	97	1,374	49	39	1,686

The total rainfall for the year (1,556 points) was 130 points below the average for the past 44 years, and that for the growing period (1,150 points) was 224 points below the average. This was largely due to the low rainfalls during September and October. Fortunately excellent rains were experienced early in November, and consequently the crops matured as if under normal conditions.

RATE OF SEEDING EXPERIMENT.

In this experiment the midseason variety "Nabawa" was planted at three different rates, viz., 90 lbs., 45 lbs., and 60 lbs. per acre. The results obtained, together with the average percentage results for the past four years, are set out hereunder:—

RATE OF SEEDING EXPERIMENT, 1929.

Planted on 15th May. Variety—Nabawa. Superphosphate (22%)—100lbs. per acre.

Rate of Seeding.	Computed Yield per acre.										Average Yields per acre, 1929.		Percentage Yields, 1929.	Average Yields per acre, 1926-29.		Percentage Yields, 1926-29.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.		bus.	lbs.	
90lbs. per acre ...	32	18	27	13	27	57	28	11	29	24	29	0	112	21	41	113
45lbs. per acre (Control)	26	33	22	46	25	1	25	52	28	48	25	48	100	19	5	100
60lbs. per acre ...	26	11	30	15	26	41	27	5	26	4	27	15	106	20	18	106

The above results conclusively indicate that, under the conditions of growth at the Avondale State Farm, applications of seed heavier than 45 lbs. per acre are profitable. The results at the experimental farms situated in portions of the Wheat Belt, other than the Great Southern, are equally conclusive in establishing that 45 lbs. per acre of seed of the variety Nabawa is sufficient.

LIMING EXPERIMENT.

The object of this experiment is to ascertain whether an application of agricultural lime at the rate of 10 cwts. per acre is advantageous to the wheat crop.

This lime was applied a month prior to seeding, viz., on the 15th April, 1929. This procedure enabled the lime to commence its actions on the soil, and so, to an extent, safeguarded the superphosphate (applied at seeding) from undue interference, and consequent excessive "reversion." All plots were planted with the variety "Nabawa," and superphosphate was applied at the rate of 100 lbs. per acre.

The results obtained for this year, together with the average results for 1927-1929, are as hereunder.—

LIMING EXPERIMENT, 1929.

Planted 15th May. Variety—Nabawa. Seed—45lbs. per acre.

Superphosphate—(22%)—100lbs. per acre.

Lime applied.	Computed Yields per acre.						Average Yields per acre, 1929.		Average Percentage Yields, 1929.	Average Yields per acre 1927-29.		Average Percentage Yields, 1927-29.
	Section 1.		Section 2.		Section 3.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.		bus.	lbs.	
10 cwts. per acre ...	25	19	25	19	26	28	25	42	96	17	33	95
No Lime	26	18	25	8	28	37	26	41	100	18	32	100

These results, which are for three years, do not so far indicate that lime, when applied in the autumn prior to seeding to this class of soil, has a beneficial effect on the wheat crop.

NITROGEN EXPERIMENT.

The objects of this experiment are:—

1. To determine whether increased yields are obtained when heavy dressings of a nitrogenous fertiliser are applied to the wheat crop in addition to an application of superphosphate.

2. To ascertain whether it is advantageous to apply only part of the nitrogenous fertiliser at seeding time and part during the month of August.

For the purposes of the experiment two rates of sulphate of ammonia were applied, viz., 1 cwt. and 2 cwts. respectively.

Superphosphate was applied to all plots at the rate of 120 lbs. per acre, and those plots to which superphosphate only was applied were treated as controls. Comparisons were made between these control plots and those plots receiving 1 cwt. and 2 cwts. of sulphate of ammonia respectively. With each of these dressings the whole of the fertiliser was applied at the one time, viz., at seeding, in the one instance, and also, in separate plots, the application of half the sulphate was delayed until the month of August.

That portion of the experiment dealing with the application of 1 cwt. of sulphate of ammonia was repeated six times, while that portion dealing with the 2 cwts. of sulphate of ammonia was repeated four times.

This experiment was conducted on both fallowed and unfallowed land (york gum and jam country).

The fallowed land had been ploughed to a depth of 4 inches with a mouldboard plough during the month of July, 1928. During October it was springtyne cultivated and disced in February to destroy weed growth. Immediately prior to seeding in May it received a further springtyne cultivation.

The unfallowed land, which had been cropped the previous year, was ploughed to a depth of 3 to 4 inches on the 5th of June, planted the following day, and harrowed immediately after. Throughout the growing period the growth and colour of the plots treated with the sulphate of ammonia showed to considerable advantage. This was particularly so with the unfallowed land.

The results obtained are tabulated hereunder:—

NITROGEN EXPERIMENT, 1929.

FALLOW.

Planted 14th May. Variety—Nabawa. Seed—45lbs. per acre.

Superphosphate (22%)—120lbs. per acre.

Treatment.	Computed Yields per acre. Section 1.	Section 2.	Section 3.	Section 4.	Section 5.	Section 6.	Average Yields per acre 1929.	Average percentage Yields, 1929.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
½ cwt. Ammonium Sulphate at seeding ½ cwt. Ammonium Sulphate in August	25 35	26 4	27 2	21 27	24 22	*	24 54	98
No Ammonium Sulphate (Control) ...	26 19	25 6	25 35	25 6	25 6	*	25 26	100
Ammonium, 1 cwt., Sulphate at seeding ...	27 16	27 17	27 46	25 35	28 30	*	27 17	107
1 cwt. Ammonium Sulphate at seeding 1 cwt. Ammonium Sulphate in August	27 46	29 58	...	23 9	24 7	...	26 15	98
No Ammonium Sulphate (Control) ...	26 33	29 58	...	25 35	25 6	...	26 48	100
2 cwts. Ammonium Sulphate at seeding ...	28 0	30 28	...	26 48	27 17	...	28 8	105

*Portions of these plots were waterlogged and the results were therefore discarded.

NITROGEN EXPERIMENT, 1929.

Non Fallow.

Planted 5th June, 1929. Variety—Nabawa. Seed—45lbs. per acre.

Superphosphate (22%)—120lbs. per acre.

Treatment.	Computed Yields per Acre.												Average yields per acre, 1929.		Average percentage yields, 1929.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.		Section 6.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
½ cwt. Ammonium Sulphate at seeding } ½ cwt. Ammonium Sulphate in August	11	42	16	19	15	50	14	22	14	8	13	53	14	22	104
No Ammonium Sulphate (Control) ...	14	51	14	37	14	37	12	11	14	22	12	40	13	53	100
1 cwt. Ammonium Sulphate at seeding ...	16	19	16	48	17	3	13	9	15	21	14	22	15	30	112
1 cwt. Ammonium Sulphate at seeding } 1 cwt. Ammonium Sulphate in August	19	0	14	22	...		16	34	13	53	...		15	57	110
No Ammonium Sulphate (Control) ...	14	8	15	21	...		13	53	15	7	...		14	37	100
2 cwts. Ammonia Sulphate at seeding ...	19	0	19	59	...		16	4	15	50	...		17	43	121

These results are not conclusive, but they indicate that on fallowed land of this type and in this district a slight advantage only is gained by applying a heavy dressing of a nitrogenous fertiliser to the wheat crop at seeding time. This advantage is lost if the application of portion of this fertiliser is delayed until August.

On the unfallowed land the indications are that the yields are increased to a greater extent than those on the fallowed land, and here again it is not advantageous to delay the application of portion of the nitrogenous fertiliser until the spring months.

OAT VARIETY TRIAL.

This experiment was conducted this year for the first time on the Avondale Farm. Five varieties were planted in each section, the standard late variety, Algerian, being taken as the control. The experiment was in triplicate, all three plots being harvested for grain.

The land was of a sandy nature, being originally timbered with sheoak and jam.

The results obtained are as follow:—

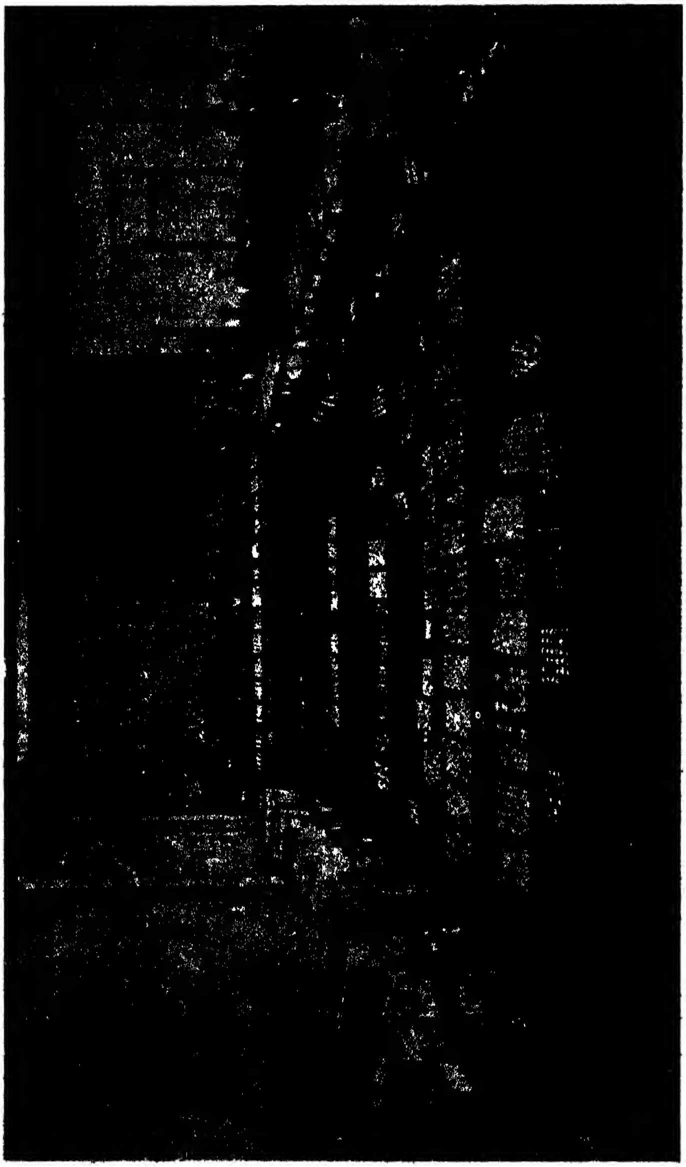
OAT VARIETY TRIAL, 1929.

Planted 13th May. Seed—40lbs. per acre. Superphosphate (22%)—100lbs. per acre.

Variety.	Maturity.	Computed Yields per acre.						Average Yield, 1929.		Average percentage Yield, 1929.
		Section 1.		Section 2.		Section 3.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
Burt's Early	Early	20	11	21	8	19	15	20	11	79
Algerian (Control) ...	Late	32	7	23	1	21	37	25	28	100
Guyra	Midseason ...	35	11	19	15	21	1	25	9	98
Lachlan	Midseason ...	26	12	17	37	15	36	20	2	76
Algerian (Control) ...	Late	32	7	23	1	24	12	26	20	100
Mulga	Early	*		18	4	19	37	19	1	70

*Results discarded owing to plot being affected by flood waters.

These results confirm those obtained at Wagin during 1927 (see "Journal," March, 1928, p. 85), viz., that the late variety Algerian and the midseason variety, Guyra, are the most suitable for grain in these districts.



THE STANDARD EGG.

W. T. RICHARDSON.

In the minds of a large majority of poultry farmers the production of standard-weight eggs—two ounces or over—appears to be a desirable object, but the methods adopted by them to reach that objective are as a general rule based on false premises. The trouble with most of them is that they have built up large flocks of birds at the expense of rate of laying coupled with grade of egg. The former calls for little knowledge and care compared with the latter, which is the result of years of careful selection in breeding, based on—

(1) constitutional vigour;
(2) body size;
(3) record of the individual performance of the breeding stock during the first laying season.

That the small-egg evil will, to a certain extent, always be with us is to be expected, given the recessive character of the "size-of-egg" factor in breeding. To-day that extent is too predominant in numbers of farms to be productive of satisfactory financial results, when considered from a purely egg-production point of view.

Constitutional vigour is indicated by the appearance, or build of the bird. Those without depth of body, width of body, and chest development lack in constitution; likewise the birds with sunken dull eyes, long snipy beaks, or with legs close together, especially at the hock, giving a "knock-kneed" appearance. The internal organs (digestive, reproductive, etc.) of a hen cannot function freely and to their full capacity if they are encased in a narrow, shallow frame. Heavy laying involves a severe strain on a hen or pullet, therefore a strong constitution is essential, otherwise a bird will be unable to stand up to the work, and not only will egg productions be seriously affected, but its health may be endangered. A vigorous constitution is closely connected with resistance to disease, both of which are inherited factors.

Any observant person may notice that undersized birds—in their respective breeds—are far too prevalent on our poultry farms. They indicate degeneration in body size, which is intimately associated with degeneration in the size of egg. Some farmers who a few years ago produced a preponderance of standard eggs find themselves to-day burdened with large quantities of undersized eggs, partly due to their disregard for body size when selecting the breeding stock.

Records of performance can only be obtained by single pen testing or trap nesting during the whole of the first laying season, when every egg laid should be individually weighed, and the weight recorded. Spasmodic attempts at testing for short periods will not indicate the performance of any bird at a later stage, either in size of egg or rate of laying. Pen averages are misleading because they do not single out the prolific layer from the possible poor layer. Weighing periods generally take place during July and/or August, and coincide with the peak period of production of standard eggs. They are not a guide to the breeding value of a bird, and create the impression that the average weight of egg shown for that period obtains for the rest of the test, irrespective of any variation in the size of egg. (See graphs in this and previous issues of the "Journal," also tables bearing on this subject.)

Generally, a hen does not attain her maximum egg size till she is in her third laying season. Most breeding operations are carried out with second and third season birds, any eggs out of the breeding pens not weighing the standard minimum (2 ozs.) being discarded. Discards are often heavy. The fact that poultry farmers generally incubate only standard eggs, expecting to obtain similar results from their flocks, is a clear indication, and justly so, that the credit "size of egg" with being an inherited factor. If their stud birds produced large quantities of undersized eggs in their first laying season, they must expect the progeny to show the same inherited tendency in their pullet season.

It does not necessarily follow that a pullet hatched out of a standard weight egg will be a producer of a large percentage of standard eggs. Possibly that particular egg may have been the only standard egg laid by its dam, or one out of a small percentage of them. We can only reasonably expect that the preponderance in size of egg in the parent stock, whatever that size may be, will be inherited by their progeny, with variations due to the recessive factor in the size of egg

A test, extending over two years, has been conducted at Muresk Agricultural College, under the supervision of the Poultry Keeper (Mr. S. Froome) to ascertain and compare the variation in grade of eggs laid by birds during their first and second season.

Independent of the Egg Laying Competition, a number of pullets are single pen tested at Muresk ever year. The feed and attention given them are identical with that of the competition birds. All eggs are individually weighed and the weight recorded. The test under review commenced on the 21st May, 1928. On 30th March, 1929, six White Leghorns that under test produced excessive numbers of eggs under 2 oz. were selected on their score card performance and again single pen tested for a further period of twelve months, i.e., to the 30th March, 1930, when the experiment terminated. Each graph indicates the performance of every individual bird during its first and second season. The black line designate standard eggs (2 oz. or over) and the dotted or broken lines the eggs under 2 oz. The progress of any of these birds in both grades of eggs can be followed by reference to the month (vertical columns) and the number of eggs laid (horizontal columns), according to the position of the respective discs. For example, Bird No. 140 (graph No. 2) laid two eggs 2 oz. or over, and 18 eggs under 2 two oz. during the month of October, 1928 (pullet season), whereas during the same period in 1929 (second season) it laid 21 eggs 2 oz. or over, and four eggs under 2 oz.

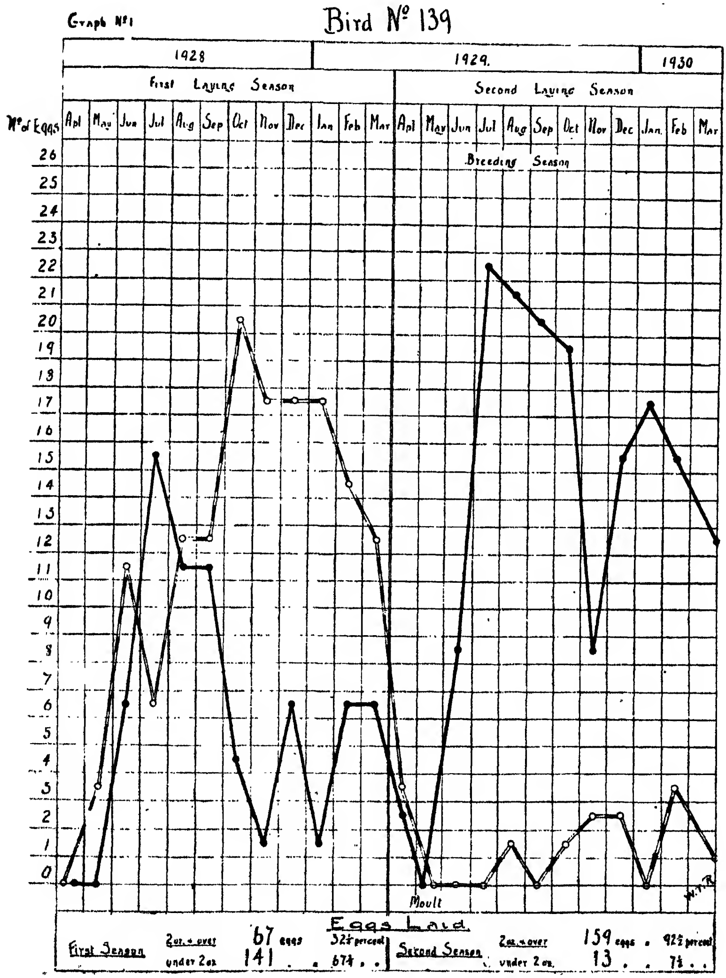
A test conducted privately has given similar results.

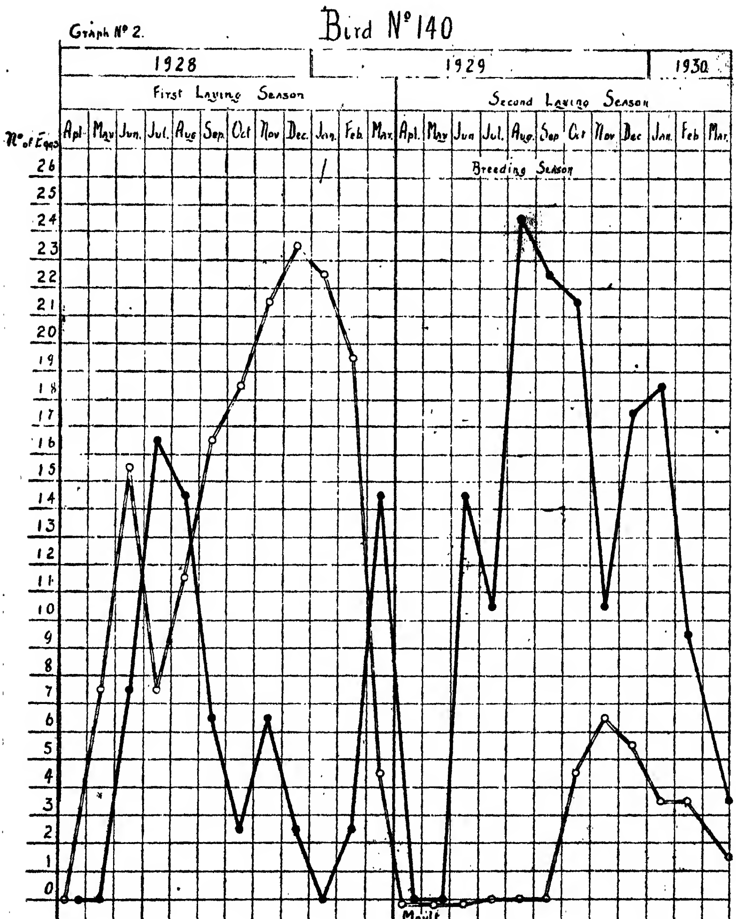
In the absence of any record of performance, hen No. 140 would appear to be a desirable breeder because during the breeding (second) season it laid 14, 10, 24 and 22 standard eggs in the months of June, July, August and September respectively, with a total absence of eggs under 2 oz.

The above experiment indicates the unsoundness of the prevalent notion that to produce layers of standard eggs, all that is required is to fill the incubators with eggs weighing not less than 2oz. laid by birds in their second or third season.

To produce and maintain the desired standard eggs, not only must the hens have produced a large preponderance of standard eggs in their pullet season, but the sire must be out of hen with similar characteristics.

Results of an Experiment conducted at Muresk Agricultural College to determine the variation in grade of egg laid by Six Single Pen Tested White Leghorn Pullets during Two consecutive years

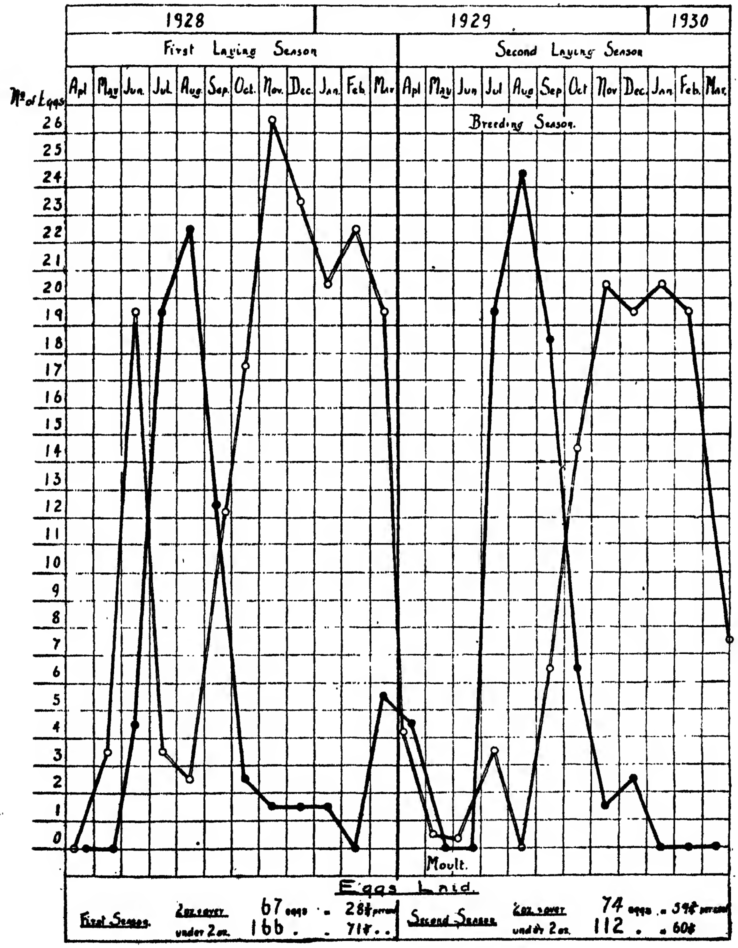


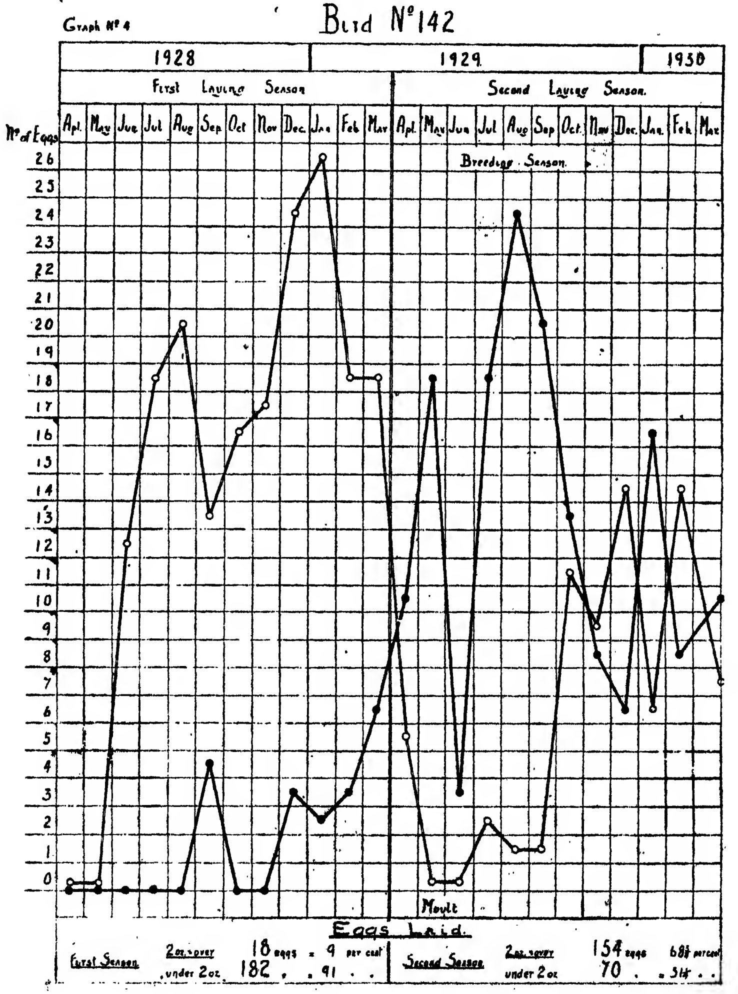


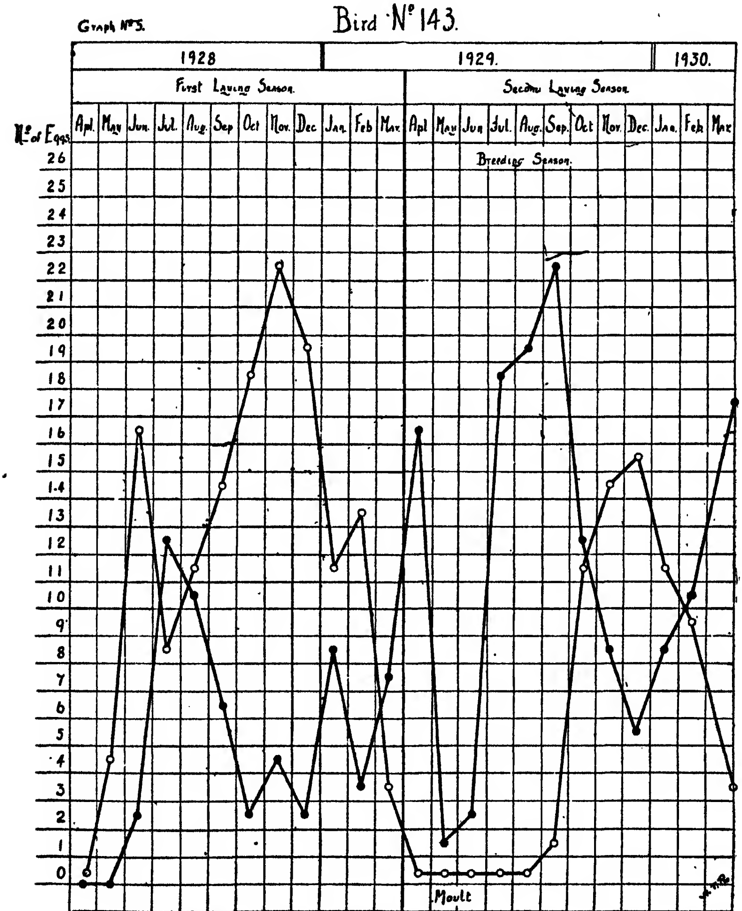
Eggs Laid

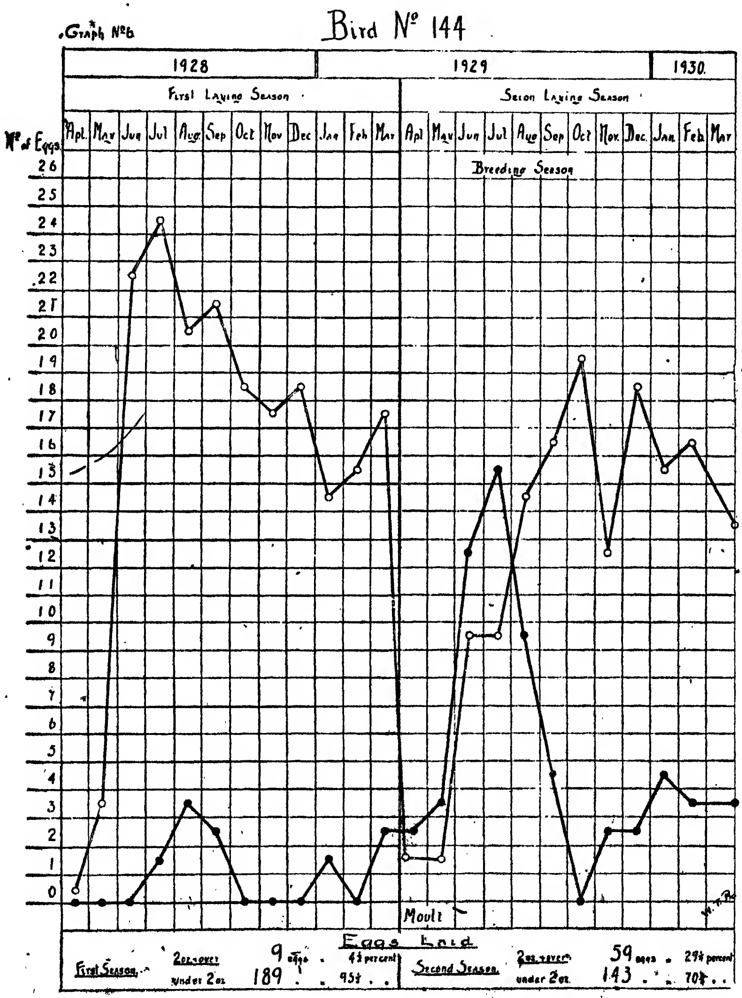
First Season.	2oz. & over.	69 eggs	29½ per cent.	Second Season.	2oz. & over	148 eggs	85½ per cent.
	under 2 oz.	163 "	70½ "		under 2 oz	25 "	14½ "

Graph No. 3. Bird No. 141.




Graph No 4
Bird No 142
1928
1929
1930
First Laying Season
Second Laying Season
Apl. May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
Apl. May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
No of Eggs
Breeding Season
Moult
Eggs Laid
First Season
2oz. & over 18 eggs = 9 per cent
under 2oz. 182 = 91
Second Season
2oz. & over 154 eggs 68¾ per cent
under 2 oz 70 = 31¼


Graph No. 5.
Bird No. 143.
1928
1929.
1930.
First Laying Season.
Second Laying Season.
Apl. May Jun. Jul. Aug. Sep. Oct Nov. Dec. Jan. Feb. Mar. Apl. May Jun Jul. Aug. Sep. Oct Nov. Dec. Jan. Feb. Mar.
No. of Eggs
26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Breeding Season.
Moult
Eggs Laid.
First Season 2oz & over 56 eggs 28% per cent
under 2oz 139 71%
Second Season 2oz & over 138 eggs 68% per cent
under 2oz 64 31%


Graph No 6
Bird No 144
1928
1929
1930.
First Laying Season
Secon Laying Season
No of Eggs
Apl. May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apl May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
Breeding Season
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Moult
Eggs Laid
First Season
2oz & over 9 eggs 4½ percent
under 2oz 189 95½
Second Season
2oz & over 59 eggs 29½ percent
under 2oz 143 70½

CARE IN CRUTCHING.

H. McCALLUM,
Sheep and Wool Inspector.

There is a right way and a wrong way to crutch sheep. Great care should be exercised when handling pregnant ewes, and on no account should they be carried from the pen. Lead the sheep out, and be careful in turning them up. The wool should be taken off as closely as possible from a little below the hock, right round the top of the tail to where it joins on to the back bone and levelled outwards.

All dirt should be cut off so as not to attract flies. When crutching there is no necessity to lean on the sheep with the knee or to press heavily on the flank with the fist. On no account should the ewes in lamb be knocked about by rough handling, or jammed through gate-ways. The ultimate results of handling ewes roughly are premature birth, mal-formations and dead lambs.

CRUTCHING.

Correct method. Incorrect method.

Many flock owners crutch their high grade ewes in a standing position, one person holding the sheep and another handling the shears. By this method there is no possibility of the lamb being turned. The standing position may be much slower, but it is certainly the safest. Through neglect of crutching dirty sheep, before shearing, a considerable poundage of good wool is wasted on account of the large percentage of stained wool.

FERTILISERS.

The following fertilisers have been registered at the Department of Agriculture under the Fertilisers Act, 1928, up to and including 15th April, 1930:—

Name of Fertiliser.	Firm.	Brand.	Fertilising Ingredients. Nitrogen as— Nitrate.	Ammonia.	Blood and Bone.	Bone.	Phosphoric Acid P_2O_5 as— Water Sol.	Citrate Sol.	Acid Sol.	Total.	Potash K_2O as— Sulphate.	Muriate.	Price per ton on rail at works or Perth.
A.—MINERAL.													
1.—NITROGENOUS.			%	%	%	%	%	%	%	%	%	%	£ s. d.
(a)—Nitrogen-nitrate.													
Nitrate of Soda	Cumming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	15·50	...	...	...	...	...	...	...	...	...	15 4 0
Do.	do.	ML in diamond ...	15·50	...	...	...	...	...	...	...	...	...	15 4 0
Do.	Cresco Fertilisers (W.A.), Ltd.	Cresco	15·00	...	...	...	...	...	...	...	...	...	16 10 0
Nitrate of Lime	do.	Cresco	15·50	...	...	...	...	...	...	...	...	...	16 0 0
Do.	J. A. Newman & Co.	BA over SF in circle	15·50	...	...	...	...	...	...	...	...	...	16 0 0
(b)—Nitrogen-ammonia.													
Sulphate of Ammonia ...	Cumming Smith, Mt. Lyell F.F. Co., Ltd.	Sickle	...	20·50	...	...	...	...	...	...	...	...	15 10 0
Do.	do.	ML in diamond ...	...	20·50	...	...	...	...	...	...	...	...	15 10 0
Do.	do.	CSML	...	20·50	...	...	...	...	...	...	...	...	15 10 0
Do.	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	20·00	...	...	...	...	...	...	...	...	15 10 0
Do.	Frank Viles ...	Imperial Chemical Industries	...	20·60	...	...	...	...	...	...	...	...	15 10 0
Do.	J. A. Newman & Co.	BA over SF in circle	...	20·60	...	...	...	...	...	...	...	...	16 0 0
Do.	C. Page & Co. ...	Page	...	21·00	...	...	...	...	...	...	...	...	14 10 0
(c)—Nitrogen—Miscellaneous.													
Calnitro	J. A. Newman & Co.	BA over SF in circle	...	20·50	...	...	...	...	...	...	...	...	16 0 0
Urea	do.	BA over SF in circle	...	46·00*	...	...	...	...	...	...	...	...	45 0 0
Floranid	do.	BA over SF in circle	...	46·00†	...	...	...	...	...	...	...	...	56 0 0

2.—PHOSPHATIC.													
(a)—Rock Phosphates.													
Pacific Islands Phosphate ...	Cuming Smith, Mt. Lyell F.F. Co., Ltd.	Sickle	...	...	...	...	...	...	36·65	36·65	...	...	4 11 6
Do.	do.	ML in diamond ...	...	...	...	...	...	...	36·65	36·65	...	...	4 11 6
Phosphate Powder	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	...	...	...	...	...	34·80	34·80	...	...	4 10 0
(b)—Superphosphates.													
Florida Superphosphate 22 per cent.	Cuming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	...	...	...	...	20·50	·50	1·00	22·00	...	...	4 10 0
High Grade Superphosphate, 22 per cent.	do.	ML in diamond ...	...	...	...	...	20·50	·50	1·00	22·00	...	...	4 10 0
Superphosphate, 22 per cent.	do.	CSML	...	...	...	...	20·50	·50	1·00	22·00	...	...	4 10 0
Florida Superphosphate, 24 per cent.	do.	Sickle	...	...	...	...	22·00	·50	1·50	24·00	...	...	4 15 0
High Grade Superphosphate, 24 per cent.	do.	ML in diamond ...	...	...	...	...	22·00	·50	1·50	24·00	...	...	4 15 0
Superphosphate, 24 per cent.	do.	CSML	...	...	...	...	22·00	·50	1·50	24·00	...	...	4 15 0
22 Superphosphate	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	...	...	...	20·50	·50	1·00	22·00	...	...	4 15 0
24 Superphosphate ...	do.	Cresco	...	...	...	...	22·00	·50	1·50	24·00	...	...	5 0 0
46 Superphosphate	do.	Cresco	...	...	...	...	46·00	...	...	46·00	...	...	11 5 0
(c)—Rock Phosphates and Super.													
Phosphate Mixture	Cuming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	...	...	...	...	10·00	1·00	18·00	29·00	...	...	4 11 6
Do.	do.	ML in diamond ...	...	...	...	...	10·00	1·00	18·00	29·00	...	...	4 11 6
50-50 Phosphate	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	...	...	...	9·16	1·84	17·40	28·40	...	...	5 0 0
(d)—Basic Phosphate.													
Basic Phosphate	Cuming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	...	...	...	...	...	...	17·00	17·00	...	...	4 14 0
Basic Phosphate	do.	ML in diamond ...	...	...	...	...	...	...	17·00	17·00	...	...	4 14 0
3.—POTASSIC.													
(a)—Potash-sulphate.													
Sulphate of Potash	Cuming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	...	...	...	...	...	...	...	...	48·60	...	13 11 6
Do.	do.	ML in diamond ...	...	...	...	...	...	...	...	...	48·60	...	13 11 6
Do.	do.	CSML	...	...	...	...	...	...	...	...	48·60	...	13 11 6
Do.	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	...	...	...	...	...	...	...	48·50	...	14 10 0
Do.	Dalgety & Co. ...	Stork	...	...	...	...	...	...	...	...	48·0	...	14 0 0
Do.	Dominions Potash Supply Co.	Sun (Diagram) ...	...	...	...	...	...	...	...	...	48·0	...	15 0 0

* As urea. † Complex combination.

FERTILISERS—*continued.*

Name of Fertiliser.	Firm.	Brand.	Nitrogen as— Nitrate.	Nitrogen as— Ammonia.	Nitrogen as— Blood and Bone.	Nitrogen as— Bone.	Phosphoric Acid P_2O_5 as— Water Sol.	Phosphoric Acid P_2O_5 as— Citrate Sol.	Phosphoric Acid P_2O_5 as— Acid Sol.	Phosphoric Acid P_2O_5 as— Total.	Potash K_2O as— Sulphate.	Potash K_2O as— Muriate.	Price per ton on rail at works or Perth.
			%	%	%	%	%	%	%	%	%	%	£ s. d.
(b)—Potash-muriate.													
Muriate of Potash	Cuming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	...	...	...	...	...	...	...	...	...	50·40	12 1 6
Do.	do.	ML in diamond ...	...	...	...	...	...	...	...	...	...	50·40	12 1 6
Do.	do.	CSML	...	...	...	...	...	...	...	...	...	50·40	12 1 6
Do.	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	...	...	...	...	...	...	...	...	50·00	12 0 0
Do.	Dalgety & Co. ...	Stork	...	...	...	...	...	...	...	...	...	50·0	12 10 0
Do.	Dominions Potash Supply Co.	Sun (Diagram) ...	...	...	...	...	...	...	...	...	...	50·0	12 10 0
4.—NITROGEN AND PHOSPHORIC ACID.													
Nitro Super.	Cuming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	...	1·50	...	...	16·00	·40	2·10	18·50	...	...	5 9 0
Do.	do.	ML in diamond ...	...	1·50	...	...	16·00	·40	2·10	18·50	...	...	5 9 0
Ammonia and Phosphate ...	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	2·00	...	...	8·30	1·60	15·70	25·60	...	...	6 5 0
Do. No. 2 ...	do.	Cresco	...	3·02	...	...	15·00	·40	1·60	17·00	...	...	7 2 6
Diammonphosphat	J. A. Newman & Co.	BA over SF in circle	...	20·60*	...	...	53·00	...	...	53·00	...	...	40 0 0
Floraphos	do.	BA over SF in circle	...	20·60*	...	...	53·00	...	...	53·00	...	...	47 0 0
Special Potato Manure C. ...	Cuming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	...	3·50	...	...	15·00	·40	1·60	17·00	...	...	6 19 0
No. 2 Potato...	do.	ML in diamond ...	...	3·50	...	...	15·00	·40	1·60	17·00	...	...	6 19 0
Potato Manure C.	do.	CSML	...	3·50	...	...	15·00	·40	1·60	17·00	...	...	6 19 0
Special Potato Manure F. ...	do.	Sickle	...	6·00	...	...	13·50	·40	1·60	15·50	...	...	8 9 0
No. 6 Potato...	do.	ML in diamond ...	...	6·00	...	...	13·50	·40	1·60	15·50	...	...	8 9 0
Potato Fertiliser X	Binney & Son ...	Swan	...	3·20	...	...	...	...	...	12·00	...	...	7 7 6
Do.	D. F. Carbarns & Co.	Crown	...	3·20	...	...	10·25	...	1·09	11·34	...	...	7 10 0

5.—NITROGEN, PHOSPHORIC ACID AND POTASH.													
Special Potato Manure B. ...	Cuming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	3·75	...	...	14·50	·35	·75	15·60	4·50	...	8	1
No. 3 Potato...	do.	ML in diamond	3·75	...	...	14·50	·35	·75	15·60	4·50	...	8	1
Potato Manure B.	do.	CSML	3·75	...	...	14·50	·35	·75	15·60	4·50	...	8	1
Special Potato Manure E. ...	do.	Sickle	3·50	...	...	14·00	·30	·70	15·00	8·00	...	8	16
No. 4 Potato...	do.	ML in diamond	3·50	...	...	14·00	·30	·70	15·00	8·00	...	8	16
Potato Manure E.	do.	CSML	3·50	...	...	14·00	·30	·70	15·00	8·00	...	8	16
Special Potato Manure G. ...	do.	Sickle	3·50	...	...	10·50	·20	·60	11·30	16·00	...	10	6
No. 7 Potato...	do.	ML in damond	3·50	...	...	10·50	·20	·60	11·30	16·00	...	10	6
Potato Manure G.	do.	CSML	3·50	...	...	10·50	·20	·60	11·30	16·00	...	10	6
Special Potato Manure H. ...	do.	Sickle	4·00	...	...	12·70	·30	·70	13·70	9·00	...	9	1
No. 8 Potato...	do.	ML in diamond	4·00	...	...	12·70	·30	·70	13·70	9·00	...	9	1
Potato Manure	Creso Fertilisers (W.A.), Ltd.	Cresco	1·50	...	...	7·10	1·40	13·50	20·00	7·50	...	7	12
Potato Special	do.	Cresco	4·00	...	...	12·50	·50	·75	13·75	8·75	...	9	10
Special Potato Fertiliser ...	Cuming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	7·50	...	...	6·40	...	...	6·40	13·25	...	11	16
Do.	do.	ML in diamond	7·50	...	...	6·40	...	...	6·40	13·25	...	11	16
Potato Fertiliser	Binney & Son ...	Swan	3·20	...	...	...	...	...	12·25	4·00	...	8	12
Do.	D. F. Carbarns & Co.	Crown	3·20	...	...	10·25	...	2·00	12·25	4·00	...	8	15
Special Fertiliser	Cuming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	8·25	...	...	8·05	·20	·39	8·64	10·00	...	12	1
Do.	do.	ML in diamond	8·25	...	...	8·05	·20	·39	8·64	10·00	...	12	1
Special Orchard Manure ...	do.	Sickle	2·00	...	...	14·00	·40	1·60	16·00	...	5·00	6	19
Do.	do.	ML in diamond	2·00	...	...	14·00	·40	1·60	16·00	...	5·00	6	19
Do.	Cresco Fertilisers (W.A.), Ltd.	Cresco	1·50	...	...	7·10	1·40	13·50	20·00	7·50	...	7	12
Nitrophoska N· 17·5, P_2O_5 13·00, K_2O· 22·00	J. A. Newman & Co.	BA over S F in circle ...	17·5	...	...	13·00	...	...	13·00	...	22·00	23	0
Do. N· 15·00, P_2O_5· 11·00, K_2O· 26·50	do.	BA over SF in circle ...	15·00	...	...	11·00	...	...	11·00	...	26·50	23	0
Do. N· 16·50, P_2O_5· 16·50, K_2O· 20·00	do.	BA over SF in circle ...	16·50	...	...	15·20	1·30	...	16·50	...	20·00	23	0
Do. N· 16·50, P_2O_5· 16·50, K_2O· 21·50	do.	BA over SF in circle ...	16·50	...	...	15·20	1·30	...	16·50	...	21·50	24	0
Do. N· 15·50, P_2O_5· 15·50, K_2O· 19·00	do.	BA over SF in circle ...	15·50	...	...	15·00	·50	...	15·50	...	19·00	23	0
Garden Fertiliser	J. Ayre & Sons ...	Palm	5·25	...	...	11·90	...	...	11·90	...	8·56	†	
Special Tomato Manure ...	Cuming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	3·50	...	...	14·00	·30	·70	15·00	8·00	...	8	16
Do.	do.	ML in diamond	3·50	...	...	14·00	·30	·70	15·00	8·00	...	8	16
Do.	do.	CSML	3·50	...	...	14·00	·30	·70	15·00	8·00	...	8	16

* Complex combination. † Sold in small lots.

FERTILISERS—*continued.*

Name of Fertiliser.	Firm.	Brand.	Nitrogen as— Nitrate.	Nitrogen as— Ammonia.	Nitrogen as— Blood and Bone.	Nitrogen as— Bone.	Phosphoric Acid P_2O_5 as— Water Sol.	Phosphoric Acid P_2O_5 as— Citrate Sol.	Phosphoric Acid P_2O_5 as— Acid Sol.	Phosphoric Acid P_2O_5 as— Total.	Potash K_2O as— Sulphate.	Potash K_2O as— Muriate.	Price per ton on rail at works or Perth.
			%	%	%	%	%	%	%	%	%	%	£ s. d.
Special Market Garden Manure	Cuming Smith, Mt. Lyell F.F. Co., Ltd.	Sickle	...	3·50	..	...	14·00	·30	·70	15·00	8·00	...	8 16 6
Do.	do.	ML in diamond		3·50	..	..	14·00	·30	·70	15·00	8·00	...	8 16 6
Vine Manure	Cresco Fertilisers (W.A.), Ltd.	Cresco	..	1·50	...	...	7·10	1·40	13·50	20·00	7·50	...	7 12 6
Mixed Manure	do.	Cresco	...	1·50	...	...	7·10	1·40	13·50	20·00	7·50	...	7 12 6
6.—MISCELLANEOUS.													
Sulphate of Iron	Cuming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	...	...	...	.	...	...	...	...	...	...	11 1 6
Iron Sulphate	do.	ML in diamond	...	...	...	...	...	...	...	...	...	...	11 1 6
Miticide Top-dressing *Fertiliser A.*	J. Ayre & Sons	Palm	...	...	...	...	...	..	15·0	15·0	...	...	*
Miticide Top-dressing *Fertiliser B.*	do.	Palm	...	...	...	...	...	...	19·0	19·0	...	...	*
B.—ORGANIC OR PARTLY ORGANIC.													
1.—ENTIRELY ANIMAL.													
(a) *Bonedust or Bonemeal.*													
Bonedust	Henry Wills & Co.	W in diamond	...	...	...	2·75	...	6·00	13·00	19·00	...	...	†10 0 0
Pure Bonedust	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	...	..	3·50	...	...	...	22·00	...	...	12 10 0
Ste[illegible] Bonedust	do.	Cresco	...	...	..	2·75	...	...	...	18·30	...	...	10 15 0
Bu[illegible]t, No. 1	Binney & Son	Swan	...	...	...	3·25	...	...	...	21·00	...	...	12 10 0
Bonedust Standard	do.	Swan	...	...	...	2·75	...	...	...	18·00	...	...	10 15 0
Bonedust	D. F. Carbarns & Co.	Crown	..	...	...	2·75	...	...	...	18·00	.	...	10 15 0
Bonedust Special, No. 1	do.	Crown	..	...	...	3·50	...	...	22·00	22·00	...	...	12 10 0
Bonedust	W.A. Meat Exports Co.	Eclipse	...	...	...	3·50	...	...	22·00	22·00	...	...	12 10 0

(b)—Bone Fertiliser.													
Globe Bone Fertiliser ...	Binney & Son ...	Swan	...	...	...	2·00	...	...	...	18·00	...	...	8 15 0
Blood and Bone	W.A. Meat Exports Co.	Eclipse	...	...	6·00	...	...	...	12·00	12·00	...	...	13 5 0
Do.	Cuming Smith Mt. Lyell F.F. Co., Ltd.	Sickle	...	...	6·00	...	...	...	12·00	12·00	...	...	12 19 0
Do.	do.	ML in diamond ...	...	...	6·00	...	...	...	12·00	12·00	...	...	12 19 0
Do.	A. H. Hassell ...	Sun	...	...	5·25	...	...	4·50	8·50	13·00	...	...	13 0 0
Do.	Haynes & Clements	A1	...	...	5·25	...	...	3·00	9·00	12·00	...	...	13 10 0
Do.	E. M. Haywood ...	Cockbill	...	...	5·00	...	...	3·00	9·00	12·00	...	...	...
Do.	State Abattoirs, Midland Junction	State Abattoirs, Midland Junction	...	...	6·00	...	...	...	9·00	9·00	...	...	12 10 0
B.B. Fertiliser	J. Tyler	Star	...	...	3·00	...	...	...	...	14·00	...	...	11 2 6
Do.	A. Richards ...	Vigor	...	...	5·00	...	...	...	...	14·00	...	...	11 2 6
Blood and Bone	Cresco Fertiliser (W.A.), Ltd.	Cresco	...	...	5·00	...	...	...	...	12·00	...	...	13 0 0
Do.	Binney & Son ...	Swan	...	...	6·00	...	...	...	...	12·00	...	...	13 0 0
B. & B. Fertiliser A. ...	do.	Swan	...	...	7·00	...	...	...	...	15·00	...	...	16 0 0
Do. B. ...	do.	Swan	...	...	6·50	...	...	...	...	12·00	...	...	13 0 0
Fish Fertiliser	do.	Swan	...	...	4·50	...	...	...	...	12·00	...	...	14 0 0
Blood and Bone	D. F. Carbarns & Co.	Crown	...	...	5·60	...	...	...	14·00	14·00	...	...	11 10 0
Do. A. ...	do.	Crown	...	...	7·00	...	...	...	15·00	15·00	...	...	16 0 0
Do. B. ...	do.	Crown	...	...	6·00	...	...	...	12·00	12·00	...	...	13 0 0
Do. ABC. ...	Paterson & Co. ...	Patco	...	...	5·25	...	...	3·00	9·00	12·00	...	...	13 0 0
Do. Globe ...	do.	Patco	...	...	5·00	...	...	...	...	9·00	...	...	‡
Do. Moon ...	do.	Patco	...	...	5·00	...	...	...	...	9·00	...	...	‡
Garden Fertiliser C. ...	Binney & Son ...	Swan	...	...	3·00	...	...	...	...	11·00	...	...	11 0 0
Do. D. ...	do.	Swan	...	...	1·7	...	...	...	...	8·30	...	...	8 10 0
2.—PARTLY ANIMAL. *(a)—Nitrogen and Phosphoric Acid.*													
Bone and Super	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	...	2·00	...	9·50	3·90	3·00	16·40	...	...	7 17 6
Do. No. 1 ...	Binney & Son ...	Swan	...	...	...	1·37	...	...	...	17·50	...	...	6 0 0
Do. No. 2 ...	do.	Swan	...	...	...	·75	...	...	...	12·00	...	...	4 0 0
Do. No. 1 ...	D. F. Carbarns & Co.	Crown	...	...	...	1·37	8·00	...	...	8·00	...	...	8 0 0
Orchard Fertiliser	Paterson & Co. ...	Patco	...	...	...	5·00	...	...	12·00	12·00	...	...	12 10 0
(b)—Nitrogen, Phosphoric Acid and Potash.													
Orchard Fertiliser	Binney & Son ...	Swan	...	...	3·00	...	...	...	...	10·00	5·00	...	12 0 0
Special Potato (Bone basis)	do.	Swan	...	...	...	3·00	...	...	...	15·00	2·25	...	9 10 0
Bone Super. Potash... ...	do.	Swan	...	...	...	1·00	...	...	...	14·00	1·00	...	5 10 0
Do.	D. F. Carbarns & Co.	Crown	...	...	...	1·00	...	...	...	14·00	1·00	...	5 10 0

* Sold in small lots. † On rails Albany. ‡ Prices not yet available.

FERTILISER VALUES.

N. DAVENPORT, B.Sc., Agric.,
Inspector of Fertilisers.

The chief aim in cropping practice is, of course, to obtain the maximum yield of marketable produce per acre. To accomplish this end, it is usually found necessary to apply to the crop a fertiliser of a particular type. As a general rule there are several of that type available, and the question naturally arises as to which is the most economical.

This is a question which is repeatedly asked by the farmer who keeps an accurate account of his costs of production and is careful against incurring unnecessary expense in his farming operations.

It would seem, at first, that a comparison of the costs per ton would be a sufficient guide. This is not so, however, as the registered minimum percentages of nitrogen, potash, etc., in each fertiliser are very seldom identical.

A system is in use, viz., that of units and unit values which enables an approximation of the comparative values of similar fertilisers to be made.

The majority of the fertilisers in use in this State are those which contain nitrogen, potash, and phosphoric acid, these constituents being known as *fertilising ingredients.* The amount of a fertilising ingredient in a fertiliser, *e.g.,* say nitrogen in sulphate of ammonia, is measured in terms of units, *a unit being one per cent. by weight in the ton.* Therefore, a sulphate of ammonia fertiliser with a guarantee of 20 per cent. of nitrogen contains 20 units of nitrogen per ton. If we contine further and say that the price of that ton is £15, then the price of 20 units is £15. Therefore, the price of one unit is £$\frac{15}{20}$. *In other words, the unit value of nitrogen as sulphate of ammonia is* 15s.

In a similar way, the unit values may be obtained of other fertilising ingredients in their various forms. It must clearly be understood that the unit values are governed by market rates and are not to be considered as a definite measure of the agricultural or fertilising value of the respective fertilising ingredients. These unit values, however, approximate fairly closely to the fertilising value, as where the price is abnormally high, the demand diminishes, with a resulting fall in price and a corresponding lowering of the unit value.

Unit values should be used only in comparing fertilisers of similar type, as manufacturing costs vary greatly with the class of fertiliser as also do the length of time and extent to which the fertilising ingredients become available.

Having arrived at all necessary unit values, we can then decide between two manures for which we have been quoted, say—

——	Guaranteed Nitrogen.	Minimum Percentages Phosphoric Acid.	Quoted price per ton.
			£ s. d.
Cab Brand Blood and Bone ...	6·5	10	14 0 0
Car Brand Blood and Bone ...	5·5	13	14 0 0

As will be seen from the appended table of unit values for 1930, that for nitrogen in blood and bone is 32s. and for phosphoric acid in blood and bone is 6s. 6d. Using these figures, we now obtain the computed value of each fertiliser, based on the fertilising ingredients which it contains—

CAB BRAND BLOOD AND BONE.

6·5 units of Nitrogen at 32/- per unit	208/-
10 units of Phosphoric Acid, at 6/6 per unit	65/-
Total value	273/-

CAR BRAND BLOOD AND BONE.

5·5 units of Nitrogen at 32/- per unit	176/-
13 units of Phosphoric Acid, at 6/6 per unit	84/6
Total value	260/6

It will be seen, therefore, that as the units contained in the Cab Brand are worth more than those of the Car Brand, the former would be the more economical fertiliser to purchase when they are both priced at £14 per ton.

The total of the unit values of each fertiliser is not necessarily equal to the market price, as the values themselves are averages of all the fertilisers of that class on sale.

In mixed mineral fertilisers, also, the cost of mixing and extra handling must be added to the cost of the ingredients which thus makes the unit values of fertilising ingredients of mixed fertilisers higher than those in simple manures.

The following table gives the list of unit values for 1930:—

UNIT VALUES FOR 1930.

NITROGEN.	
as Blood and Bone, Bonedust, and Bone and Flesh ...	32–0
„ Nitrate	20–6
„ Urea	19–6
„ Ammonia	15–3
PHOSPHORIC ACID.	
as *Water Soluble*	4–2
as *Citrate Soluble*—	
in Blood and Bone, Bonedust, and other animal fertilisers	6–6
In other fertilisers	4–2
as *Acid Soluble*—	
in Blood and Bone, Bonedust, and other animal fertilisers	6–6
„ Basis Phosphate	5–6
„ Ammonia and Phosphate	3–4
„ Superphosphate and Rock Phosphate	2–6
„ Other fertilisers	1–0
POTASH.	
as Sulphate	5–6
„ Muriate	4–10

THE POLLINATION OF ORCHARDS.

H. WILLOUGHBY LANCE,
Apiculturist.

An article appeared in this Journal for December, 1927, showing the results of experiments dealing with the pollination of prune trees by bees.

It is greatly to be feared, however, that orchardists do not realise the importance of the presence of bees in their orchards; or if they do realise it, they are either content with the crop they have, are too much afraid of the handling of bees, or have not enough energy and enterprise to arrange for the installation of these most important agents in the fertilisation of their trees. Experiments in America during the last few years have brought home to the orchardist the importance of bees as fertilising agents, so much so that it is quite common for hundreds of hives of bees to be transported to orchards for the blossoming period and the bee-keeper to be well paid by the orchardist for so doing. Other orchardists are studying bee-keeping and adding honey production to their activities.

Generally speaking, orchardists in this State do not realise the importance of having bees on the spot and on the right spot. It is not enough to have bees in the bush. Very often at blossoming time the weather is cold, cloudy, or showery. At such times bees in an orchard will slip out during intervals of sunshine, while bees in the bush will not be tempted out, or will not have the time to reach the orchard.

Of course other agencies besides bees are necessary for the pollination of blossom. The wind, some classes of birds, and indigenous insects, all have their part to play in the pollination of wild flora, but it is nevertheless true that modern fruit culture requires the special agency of the honey bee.

A. I. Root, of Medina, U.S.A., says:—"In sections where immense orchards cover many square miles of territory and fruit is grown by the ton and car load, the wild insects are wholly indaquate to pollinate the great expanse of bloom and many apiaries must be established to obtain the best results. The only pollinating insects under the control of man are honey bees, and these must be introduced in large numbers in order to make fruit-growing commercially profitable. Fruit growing has a marvellous future before it and must be associated with bee culture."

In the "Agricultural Journal" of December, 1927, we gave particulars of experiments carried out in California on the setting of the fruit of prune trees. A summary of this shows the immense value of bees. The orchard in which the test was made covered 180 acres. In 1916 there were no hives of bees in the orchard, but in 1917 there were 115. Trees were enclosed so as to exclude bees, other trees were enclosed so as to enclose bees. The result was as follows:—

	1916. No Bees.	1917. Bees.
Set of tree from which bees were excluded ..	1.04	0.43
Average set of orchard, unenclosed	3.59	13.2
Set of tree with bees enclosed	18.05	19.0

It will be noted that the average setting with no bees in the orchard in 1916 was 3.59, and that this was increased to 13.2 in 1917, when the hives had been placed in the orchard.

Since this date many experiments have been made in relation to the pollination of fruit trees; and in many orchards of self sterile trees, it has become the practice to place bouquets of bloom from another variety in proximity to the self sterile trees, and to place hives of bees in the orchard for their fertilisation.

Orchardists must realise that it is not sufficient to have a hive of bees in the vicinity of the orchard. The hive must be in the right position. It must also be in the right condition at blossoming time and if necessary the orchardist must assist the bees by placing bouquets of fresh blossom in their line of flight that they may visit these first and carry the pollen with them to the trees. In other words, the orchardist must understand and look after his bees just as much as his trees.

To get the best results from bees in an orchard, they should be in full strength at blossoming time. This in some districts may mean feeding the bees about five weeks previously to induce rapid breeding and ensure a large field force when the blossoms are out.

As soon, therefore, in the spring as the weather allows, all hives should be opened up to see the condition and make sure that there is a good breeding queen, plenty of stores, both honey and pollen, also plenty of room for egg laying. If there is plenty of honey in the hive, but none being gathered some of it should be uncapped to induce the commencement of brood rearing.

A good book that can be recommended to the small bee-keeper is "The Beginner in Bee Culture," by W. A. Goodacre, issued by the New South Wales Department of Agriculture, post free 1s. 1d.

As a rule bees, when they leave the hive, seem to know just where they are going, and strive to arrive there in the shortest possible time. While there is nectar and pollen to be gathered from blossom, bees will absolutely ignore even honey placed on the ground a few feet away from the hive. For this reason, it has been noted that "tub bouquets" placed on the ground in front of the hives in many orchards have failed to give the desired results. The bees seem to have the trees in mind, and fly right over the tempting supply of nectar and pollen without stopping to investigate.

Messrs. Kremer and Hootman, in "Gleanings in Bee Culture," give some interesting facts about practical work with colonies of bees and bouquets in orchards and the following is an extract therefrom:—

Proper Placing of Bouquets.

"Realising that the placing of the bouquet on the ground often defeated the object desired—namely, enticing the bee to visit the blossoms on its way to the field, a better method or one that called for the placing of the bouquets in the line of flight between trees was tried in a limited area in both a McIntosh and a Northern Spy orchard this past year. The "set" of fruit in each case was increased from 10 to 14 per cent. by using this method.

"On cool or windy days the bees show a preference for the blossoms on the sunny side of the trees. Unless the temperature is sufficiently high to induce the bees to fly freely around the tree, the majority of the fruit will be on the sunny side.

When the bouquets were placed in pails of water and hung on tripods between the trees in the line of flight, the bees visited the blossoms of the bouquets as readily as those of the tree. When bouquets were suspended from a limb of the tree in the shade, and the weather was somewhat cool, the

bees were disinclined to enter the shady area with the result that the bouquet did not prove entirely efficient in that position.

Several counts made of the visit of bees to the bouquets in different positions under the same weather conditions revealed that the bouquets placed in the line of flight of the bee when it has begun its search for nectar or pollen received at least five times as many visits per minute as a bouquet in any other position."

Bees Double Fruit Crop.

For pollination purposes, the importance of distributing the colonies through the orchard during the blossoming period must be carefully considered. The experience this past season of Frank Street, Manager of the Kentucky Cardinal Orchards, of Henderson, Kentucky, well illustrates this point.

On the strength of facts brought out in a recent pollination publication, he placed 50 colonies of bees in a 45-acre tract of Winesaps, in which the pollinating variety was Champion, this variety being planted every third tree in every third row. The bees were placed about ten feet away and facing the pollinating variety.

They had two other tracts of orchard of about equal producing capacity, located six and eight miles from the orchard under discussion. The following are the harvesting records on these three orchards from September 15 to October 15. The varieties in the main are Winesap, Stayman, Delicious, Ben Davis and Champion.

The bees were distributed in the Green Farm Orchard at the rate of about one colony to the acre, as indicated above. The other orchards were situated near colonies of bees, but no bees were placed directly in the orchard. The Park Orchard, on which the pollination appeared the poorest, was within 2,000 feet of a commercial apiary, but the bees had to cross a wind swept valley to reach the orchard. Rain and high winds interfered with their normal flight during the bloom.

Farm.	Hand picked.	Drops.	Total bu.
Park Orchard	5,661	3,800	9,461
Home Farm	5,839	3,060	8,899
Green Farm (bees) ..	14,381	2,872	17,253

In the table above, we would like to call attention to the fact that from pollination the number of bushels of drops or ground fruit was not only reduced, but the total yield was nearly doubled. Did it pay to distribute the colonies through the orchard?

Location in Orchard Important.

To assure sufficient insect activity under adverse weather conditions at blossoming time, strong colonies of bees should be distributed in mature orchards at the rate of about one colony to the acre. Bee flight will be encouraged and better results obtained by locating the colonies in sunny wind-sheltered locations, away from exposed locations swept by strong winds. When wind is blowing over 20 miles an hour, cross currents and eddies are created among the trees which are avoided by the bees. These condiitons are unfavourable to the bees, and their flight under such conditions is greatly reduced.

Distributing the colonies through the orchard will provide for the most economical utilisation of any flight that is made. For pollination purposes, the place for the colonies during blossom time is in or very near the orchard, not in an apiary a half mile or more from the orchard.

NUNGARIN AGRICULTURAL SOCIETY.

FALLOW COMPETITION, 1929/30.

Judge—H. RUDALL, Field Officer.

Nineteen entries were received for the Fallow Competition conducted by the Nungarin Agricultural Society. Thirteen of these submitted their fallow for adjudication. The judging was based on the same scale of points as in previous competitions, namely:—

	Points.
Moisture	40
Condition of mulch	10
Freedom from weeds	10
Consolidation of seed bed	20
Uniformity of preparation	20
Total	100

Judging was commenced on the 17th March and completed on the 20th. A fairly general thunderstorm fell over most of the area about 10 days before judging took place.

The rainfall recorded at various centres from June until 20th March is shown hereunder:—

	Fallowing rains.				Spring rains.			Summer rains.						Total Rainfall June to 20th March.
	June.	July.	Aug.	Total.	Sep.	Oct.	Total.	Nov.	Dec.	Jan.	Feb.	Mar.	Total.	
Nungarin ...	249	104	86	439	14	55	69	225	...	...	24	177	426	934
Creagh Bros.	240	105	71	416	15	65	80	181	...	...	11	130	322	818
Lake Brown	153	54	59	266	15	53	68	205	...	...	...	84	289	623
Talgomine Downs	269	70	68	407	14	72	86	204	...	...	15	218	437	930
Jolly, J. ...	246	66	88	400	21	99	120	288	...	...	...	166	454	974

The competing areas of fallow which were outstanding were those submitted by Mr. H. P. Jolly and Mr. F. A. Williams.

Mr. Jolly's was long summer fallow, ploughed in February, and subsequent working and implements were such that, with the turf-like feeling underfoot, one felt and ultimately found a mulch of desirable tilth and depth, with a level and well consolidated seedbed, without clods being buried. The moisture content was high at a depth from 8 to 12 inches.

Mr. Williams' competing plot might have shown more uniformity in preparation if a plough had been used for the initial operation, followed by the springtyne cultivator and harrows in November. The uneven depth of the initial working (scarifying) was more pronounced than in Mr. Jolly's. The consolidation was a little too firm and the moisture content was not as pronounced at the same depth as the successful competitor.

With these two entries of such a high standard, my task was made easy when examining the other entries.

The following table summarises the cultural methods and shows the points awarded:—

Competitor and District.	Original Timber.	Rotation.	Time of Fallowing.	Type of Plough.	Depth of Ploughing.	Condition of Land at time of Ploughing.	If Sheep fed.
					ins.		
Jolly, H. P. Mangowine	Salmon and Gimlet	Crop and fallow	February	Disc (sundercut)	3½	Good	Yes
Williams, F. A. Mangowine	Salmon, Gimlet, Mallee	do.	June	Duckfoot scarifier	3½	Good	Yes
Creagh Bros., Kwelkan	Gimlet, Mallee, Jam	do.	June	Disc	4	Good	Yes
Dunsday, L., Talgomine	Salmon and Gimlet	do.	July	Disc	3½	Good	No
Fitzpatrick, R. C., Nungarin	Salmon, Gimlet, Morrell	do.	July	Disc (sundercut)	3½	Good	No
Jolly, J., Mangowine	Yorrell, Tea-tree, Morrell, Salmon and Gimlet	do.	July	Skim	4	Good	No
Goode, H. E., Mangowine	Salmon and Gimlet	do.	June	Disc (sundercut)	3	Good	No
Duthie, W. J., Mukinbudin	Mallee, Jam Scrub	do	May	Disc	3½	Good	Yes
Mulqueeny, J., Lake Brown	Salmon and Gimlet	do	June	Disc (sundercut)	3½	Good	No
Hocking, F., Nungarin	Salmon, Tea-tree, Mallee	do	July	Disc (sundercut)	3½	Good	No.
Watson Bros., Nungarin	Salmon and Gimlet	do	July	Disc (sundercut)	4	Good	Yes
Dawe, F. J. W., Nungarin	Morrell, Salmon, Gimlet	Two crops and fallow	June	Disc	3½	Good	No
Stockdale, Mrs., Talgomine	Mallee, Jam, Salmon and Gimlet	First fallow	July	Disc	3½	Good	No

Competitor.	Cultivations.	Moisture.	Mulch.	Absence of Weeds.	Consolidation.	Uniformity of Preparation.	Total.
Jolly, H. P.	Skim M.B., June, springtyne and harrowed end July and end of August. Sundercutted (disced) and harrowed September. Harrowed March	37	9	9	19	19	93
Williams, F. A.	Scarified (duckfoot) and harrowed September. Scarified and harrowed November. Harrowed March	36	9	9	18	18	90
Creagh Bros.	Sundercutted (disced) August, springtyned November, combined (cultivator drill) March	34	8	9	18	17	86
Dumsday, L.	Cross ploughed July. Portion scarified (duckfoot) and portions springtyned October and November. Combined (cultivator drill) March	34	8	9	18	17	86
Fitzpatrick, R. C.	Cross sundercutted (disced) in August. Combined (cultivator drill) November, and in March	34	8	9	18	17	86
Jolly, J.	Skim ploughed September and harrowed. Springtyned November. Harrowed March	34	8	9	18	17	86
Goode, H. E.	Springtyned and crossed in July. Sundercutted (disced) and harrowed November	32	7	8	17	17	81
Duthie, W. J.	Springtyned in August and harrowed November	32	7	8	17	17	81
Mulqueeny, J.	Skim ploughed in July and August. Harrowed and portion springtyned in November	32	7	8	17	17	81
Hocking, F.	Sundercutted (disced) August. Sundercutted September. Combined (cultivator drill) October. Sundercutted November	32	7	8	17	17	79
Watson Bros.	Skimmed with sundercut September. Harrowed March	32	7	8	16	15	78
Dawe, F. J. W.	Skim ploughed in September. Sundercutted (disced) November ...	30	7	8	15	15	75
Stockdale, Mrs.	Springtyned and harrowed August. Rolled and harrowed September. Springtyned and harrowed November. Springtyned February	30	6	7	15	15	73

Perusal of the recorded rainfall at the various centres shows that the spring rains were very light. In November a heavy downpour occurred. This falling at harvest time was perhaps most inopportune because time and labour may have only permitted the whole of the acreage fallowed being rushed over. Had attention been concentrated on a portion, and this thoroughly worked to conserve all the moisture possible, some of the fallows examined would have then shown more moisture below the depth of ploughing which would be available for the depleted subsurface soil. In many cases for this cultivation the sundercut and combine-cultivator-drill were used in an endeavour to form a suitable mulch. The former implement (sundercut) gave too great a depth of mulch with numerous air pockets caused by covered clods which provided many exaporating tubes, and with the latter machine (combine cultivator-drill) more care might have been exercised in regulating the depth, thereby avoiding a mulch almost to the depth of ploughing. The March rains were most valuable to those fallows worked properly; but again the sundercut and combine-cultivator-drill were providing a mulch of too great a depth.

It would be well if more farmers realised the value of the March and April rains and the necessity for the immediate cultivation of the fallow to restore the mulch which will assist to conserve as much moisture as possible, as an insurance against a late starting or a light winter's rainfall. This is supported by Departmental records of the Demonstration Plots at Kalgoorlie in 1927. Five inches of rain were recorded during March. The soil was immediately worked. No further rains were experienced until May, when the seed was sown. Three and a-half inches were recorded during the growing period, and the very early variety Noongaar returned 25 bushels to the acre.

Experiments have proved that the more moisture conserved on the fallowed land in the Eastern Wheat Belt means better fallow, and better fallow means bigger yields.

It is nearly four years since my last visit to this district, and some of the fields when first taken up were cropped continuously for some years, followed later by a fallow-wheat rotation. It was noticed in some instances on the heavier soil that there was a most decided lack of compaction of the surface soil. This is more noticeable after a season of light rainfall than after an average one. It occurred to me that a timely warning might be sounded that perhaps the fallow-wheat rotation is being continued a little too long, thereby impoverishing the soil by depleting the humus which is so necessary to maintain its fertility. Now that many farmers have the water available on their holdings, through the reticulation from the rock catchments, and are able to run sheep, it might be advisable to consider a longer rotation, so as to include a pasture or fodder crop which would be beneficial in assisting to restore the humus so necessary to the fertility of the soil.

OAT VARIETY TRIALS AT DENMARK.

J. T. ARMSTRONG, B.Sc. (Agric.),
Senior Agricultural Adviser.

Last year several Oat Variety Trials were conducted in the Denmark district, using the varieties Burt's Early, Lachlan, Guyra.

The growth of "Lachlan" and "Guyra" was similar until September, when "Lachlan" forged ahead of the latter variety and eventually yielded considerably better.

It is considered that, if the crop is to grow through the winter, the soil should be left cloddy and open so as to permit of better aeration. This was shown on Mr. Russell's plot, where the mulch was worked too finely, and the soil became cold and water-logged in the winter. Where the crop is grown for early feed, the mulch should be made very fine.

The experiment shows that for early winter and spring feeding, "Lachlan" is the best of these three varieties in this district.

The following are the details of the trials:—

E. Russell, Group 42, *Denmark.*

Soil—light brown friable loam previously growing maize which was cut in February. On account of the friable nature of the soil, the lower plots became cold and water-logged in the winter, and sections were consequently only cut from plots on higher land.

Cultivation. Land was ploughed and harrowed four times prior to seeding.

Seeded: 21st March, 1929,
Rates: Seed, 1 bushel oats per acre.
Superphosphate, 2 cwts. per acre.
Seed and manure harrowed in.
Harvested first week in November, 1929.
Yields: "Guyra"—3 tons 12 cwts.
"Lachlan"—4 tons 6¼ cwts.
"Burt's Early"—2 tons 17½ cwts. per acre.

F. Smith, Group 41, *Denmark.*

Soil—red karri loam, rocky in places.
Cultivation. Cleared in December, 1928, ploughed with share plough in January, 1929, then disc cultivated and reploughed early in February, 1929, and harrowed twice.
Seeded: 20th March, 1929.
Rates: Seed, 50 lbs. oats per acre.
Superphosphate, 2 cwts. per acre.
Yield: "Guyra"—3 tons 12 cwts.
"Lachlan"—5 tons 8 cwts.
"Burt's Early"—4 tons 7½ cwts.

K. Testar, Group 100, *Denmark.*

Soil—red loam varying to lighter sandy loam, carrying originally jarrah and red gum.

Cultivation. Cleared December, 1928. Ploughed December, 1928, re-ploughed in January, then harrowed twice, and harrowed twice with tyne harrows.

Seeded on 26th March, 1929.

Rates: Seed, 1 bushel oats per acre
Superphosphate, 2 cwts. per acre.

Harvested at end of October.

Yield: "Lachlan"—3 tons 10 cwts.
"Guyra"—3 tons 1 cwt.
"Burt's Early"—3 tons 1 cwt.

The following are the average yields from the three plots:—

—	Per acre		Percentage Yield.
	tons	cwts	
"Lachlan"	4	8	100
"Burt's Early"	3	9	78
"Guyra"	3	8	78

A COMPARISON BETWEEN OATS AND CAPE BARLEY FOR EARLY WINTER FEED

Last year an experiment was conducted on Group Settlement holdings at Denmark, comparing the suitability of oats and Cape barley for early winter feed. "Burt's Early" was the oat variety used.

The experiment proved that, on reasonably good country, "Burt's Early" oats will give earlier and more feed than Cape barley, and stock prefer the oats to the barley.

In this district the land should be ploughed in the summer, and seeded in February, either with "Burt's Early" or "Lachlan" oats.

The following are the details of the experiment:—

J. Ilsley, Group 41

Soil: Medium to light loam, growing in its virgin state karri and sheoak.

Cleared in January, 1929, ploughed with share plough in February, re-ploughed, disc cultivated and harrowed four times and again after seeding.

Seeded: 25th March, 1929.

Rates of Seeding: 1 bushel oats, 1 bushel barley per acre.

Fertiliser: 2 cwts. superphosphate per acre

The crop was fed off on the 12th June, and was then estimated to yield:—

Oats—3 tons 7½ cwts.
Barley—18½ cwts.

After being fed off, the oats came away first and yielded more feed than the barley.

J Hodgson, Group 41.

Soil: Gravelly loam carrying in its virgin state karri and sheoak.

Cleared in 1926 and laid down with pasture which proved a failure.

Ploughed in early March and then cultivated and harrowed.

Seeded: 25th March, 1929.

Rate of Seeding: 1½ bushels oats, 1½ bushels barley per acre.

Fertiliser: 2 cwts superphosphate per acre.

The oats made quicker and more growth than the barley, and were of a better colour.

The crop was fed off in early June and estimated to yield:—

Oats—2 tons 3 cwts.
Barley—1 ton 16 cwts.

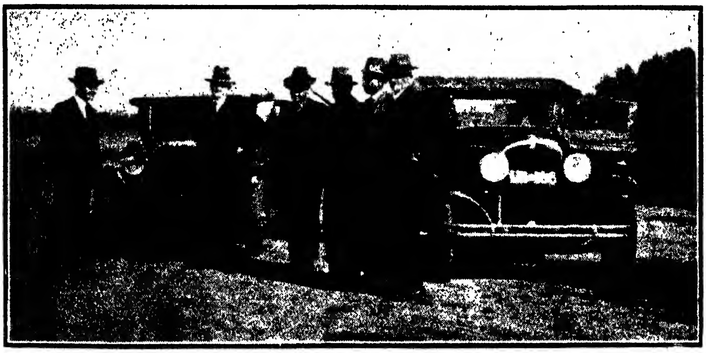
As in the former experiment, after feeding off, the oats gave quicker and better returns than the barley.

The average results of the two trials are as follows:—

——	Yield of Green Fodder before closing for hay.		Percentage Yields.
	tons.	cwts.	
Oats	2	15¼	100
Barley	1	17¼	67

MINISTER'S VISIT TO MERREDIN EXPERIMENT FARM.

Visit to the Merredin Experiment Farm on 10th May, 1930, of the Hon. P. D. Ferguson, Minister for Agriculture, Professor Prescott and party. Reading from left to right—Dr. L. J. H. Teakle, Plant Nutrition Officer;



Minister at Merredin Experiment Farm.

Hon. P. D. Ferguson, Minister for Agriculture; Mr. Geo. L. Sutton, Director of Agriculture: Professor J. A. Prescott, Chief of the Division of Soil Research in the Waite Agricultural Research Institute, Adelaide; Messrs. J. H. Langfield, Manager of the Merredin Experiment Farm, and I. Thomas, Superintendent of Wheat Farms.

BUNT RESISTANCE TESTS, 1929.

E. J. LIMBOURN, Cereal Breeder, Experiment Farm, Merredin.

The experiment dealing with the resistance or susceptibility of wheat varieties to the disease known generally as "Bunt" or "Smut" (*Tilletia levis*) was again carried out during the past season on the same lines as the tests described in the March (1929) issue of this Journal.

The varieties tested this year were those which, in previous tests, had shown a high—75 per cent.—resistance to the disease; new ones and new strains of old ones.

For instance, "Canimbla" (p. 1729), gave an infection of 56 per cent. when tested in 1927, but a slightly improved strain (p. 1821) was received during 1928, and it was necessary to obtain information as to its resistance to disease. It will be seen that there is no improvement as regards its resistance to Bunt.

The method of infection and conditions of planting as then explained were again adopted with the exception that the variety "Gluyas Early" was used as the control instead of the variety "Booran."

The following is a list of the varieties tested, with the percentage of infection found. The variation in the relation between the number of infected plants and the percentage of infection is due to the fact that the percentage is computed from the actual number of mature plants. One hundred grains are planted of each variety, but the loss of plants during growth varies considerably.

VARIETAL RESISTANCE AS SHOWN BY INFECTION PER ROW.

1929.

Variety.	Reg. No.	Infected plants per row.	Percentage infection per row.
			%
Gluyas Early	P 159	19	20
(Akakomuga x Bald Early)	P 1847	40	44
(Bald Medeah x Bobs)	P 1943	19	25
(Comeback x Minister)	P 1842	22	31
(Federation x Bald Medeah)	P 1838	26	33
(Federation x Bunyip)	C 70	6	7
Gluyas Early	P 159	21	25
Gluyas Early	P 159	17	18
(Florence x Nabawa)...	C 81	1	1
(Gallipoli x Federation)	P 1939	11	22

VARIETAL RESISTANCE AS SHOWN BY INFECTION PER ROW—*continued.*

1929.

Variety.	Reg. No.	Infected plants per row.	Percentage infection per row.
(Gallipoli x Federation)	P 1940	5	14
(Hard Federation x Yellow Marquis) ...	P 1937	34	50
(Nabawa x Carrabin)	C 66	4	5
Gluyas Early	P 159	11	13
Gluyas Early	P 159	27	31
Bindu	P 1887	17	21
Canimbla	P 1821	55	66
Carwarp	P 1835	24	29
Cedar	P 222	2	3
Coral	P 1891	8	15
Gluyas Early	P 159	23	30
Gluyas Early	P 159	27	31
Cowhort	P 1938	22	32
Currimp-Seln. from Chapman Exp. Farm	P 1747	40	53
Dookie Delta	P 1744	20	26
Ford	P 915	1	1
For indentification	P 1892	...	...
Gluyas Early	P 159	30	37
Gluyas Early	P 159	23	28
Genoa	P 1511	...	...
Inderet	P 1750	42	49
Kings White	P 1368	35	42
Marshalls No. 3	P 1374	40	54
Minflor (Seln.)	P 1753	1	1
Gluyas Early	P 159	17	23
Gluyas Early	P 159	31	64
Perfection	P 1929	32	50
Piastre	P 1460	...	...
Stewart	P 1831	43	58
Suvla	P 1699	23	32
Whillan	P 1841	43	64
Gluyas Early	P 159	24	28

"Genoa" (p. 1511) has again proved immune, this being the sixth year in succession that it has been entirely free from infection. It is a very late maturing variety, and for that reason cannot be recommended for growing commercially.

BEE HIVES.

H. WILLOUGHBY LANCE,
Apiculturist.

At this season of the year, when outside work in the Apiary is practically at a standstill, the subject of hives is a suitable one.

All practical bee-keepers should, during the winter months, overhaul all spare hives and parts thereof, and, if expecting to increase, prepare new ones. We presume that all spare combs in good condition have been safely stored, either on the hives or in some suitable place to keep them free from moth; if any have been put away in cupboards or rooms it would be well to examine them at intervals to see that they are free of moth.

All frames with damaged or old combs should have had the combs cut out and melted down. These frames will need overhauling, repairing and tightening, then they may be wired ready for the foundation, which in nine cases out of 10, should be full sheets.

Now, as regards hives, it is surprising what a number of old box hives and badly kept frame hives with cross comb, making it impossible to examine the brood chamber, one finds in some districts. I would here like to remind bee-keepers that such methods of keeping bees is contrary to regulations and anyone found with hives which cannot be easily and efficiently examined is liable to a fine

Some bee-keepers have many odd size hives, very often due to purchasing stocks of bees from different persons. It would be wise for all such to decide which hive suits their method of working and the district best, then make this their standard and gradually eliminate all others. Nothing is more annoying than to find, when a hive requires a spare super, that one has every other pattern except that required.

Generally speaking, there are two types of hives, single wall and double wall.

The single wall type is that mostly in use in this country, principally for two reasons—it being cheaper, and, where hives are moved about to catch the honey flow, it is much more easy to transport.

The double wall type is used very largely in England and some parts of America. It is practically one hive inside a larger one, but both standing on the same floor board. Both the inside box and the outer cover are usually made of half-inch wood. A quilt or wood ceiling is laid on top of the frames and there is a space of several inches between this and the roof, which allows an air space all round and on top of the hive proper. In cold climates this space is packed with paper or other material to conserve the heat. In summer the circulation of air keeps the hive cool. Where an apiarist does not move his hives from one district to another, this is an excellent hive for our hot climate. I have made several of these and never find the bees hanging out in hot weather as with single wall hives. I also consider that I get more honey from these hives, although I have never made an actual test of same.

Figure (1) shows a "W B C" double wall hive with gable roof. Figure (2) shows section of similar hive with sloping roof.

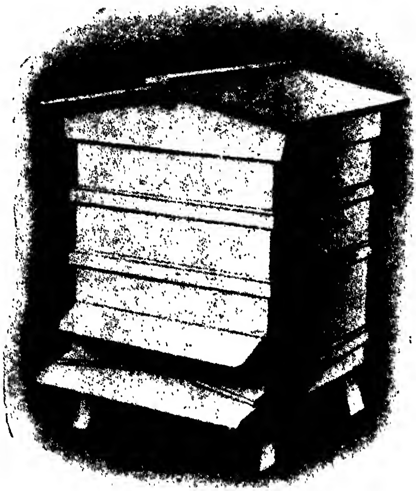


Fig. 1.

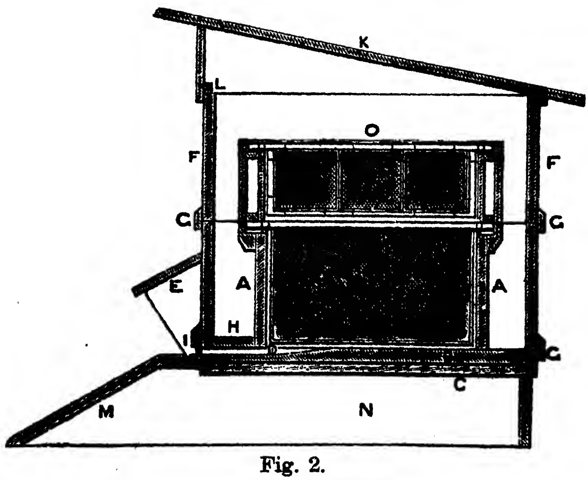


Fig. 2.

The type of single wall hive in most general use in Australia and America is the Langstroth pattern, which has practically become the standard. This hive has frames 17 5/8 inches long by 9 1/8 inches high for the brood chamber. Factory-made hives of this pattern are made of selected timber 7/8 inch thick, the overall dimensions being 20 inches by 16 inches.

Some bee-keepers make their own hives after the Langstroth pattern from petrol cases, but in very many cases these are not satisfactory, either

from lack of knowledge of the requirements of a hive, or from indifferent workmanship. The half-inch wood of petrol cases is not sufficient; two thicknesses should be used. A strip of wood nailed on the inside of the ends instead of rabbeting, is not satisfactory, as it leaves space for the building of comb. All joints, especially those of hives made from petrol cases, should be painted before being nailed together.

Home-made Hives—

For the benefit of those who wish to make their own hives the following particulars are given:—

The standard sizes of factory hives are 8 and 10-frame. The petrol case will make a good 9-frame hive.

The inside width of an 8-fame hive is 12⅛ inches; that of a 10-frame 14¼. A petrol case will make a hive 13¾. Standard frames are 1⅜ inches wide; 10 of these would equal 13¾ inches and be a tight fit, and be very

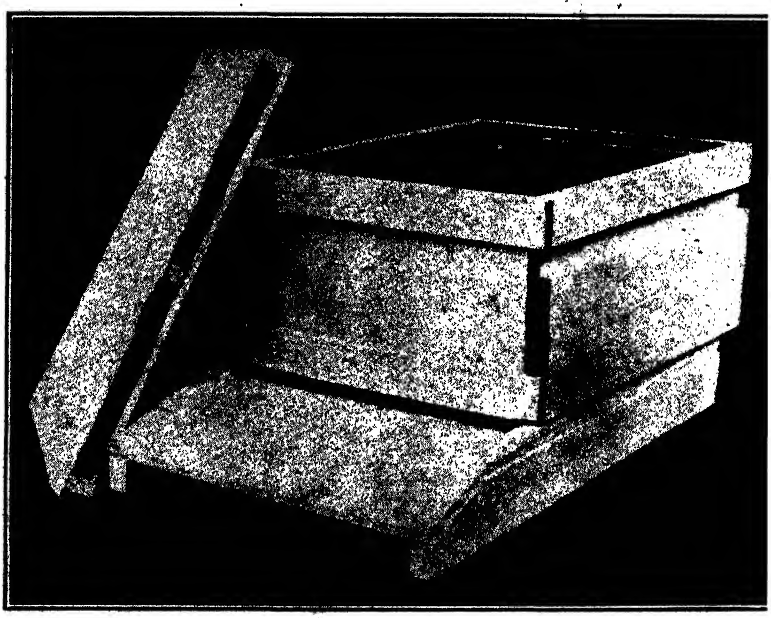


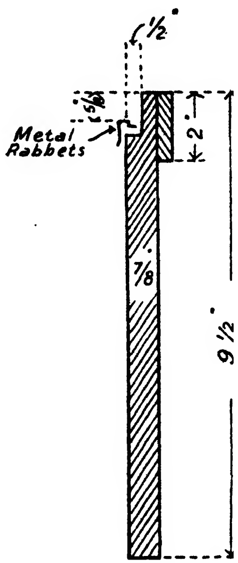
Fig. 3.

difficult to manipulate. These hives, therefore, should only be used for 9 frames. In the supers these frames can be spaced out equally and should produce good fat combs easy to uncap, but in the brood chamber they should be placed close together and a dummy board, say of ⅞ inch wood, inserted to take up the extra space. The reason for this is that the natural spacing of brood combs is 1⅜ inches. Drone brood requires a larger space, and if combs are further apart, the bees have greater facilities and inducements to build drone comb.

Figure 3 is a photograph of the complete hive shown with the body drawn back a little and the roof at the side. The floor is made of the sides of a

petrol case half-inch thick, but if thicker wood is obtainable, so much the better. These are cut 15¾ inches long, nailed to two pieces of 3 x 1 jarrah, and sloped off at front to allow of a good alighting board for the bees. The length of the level portion should be at least 23 inches. On this surface, along the back of the two slides, nail strips of wood 1in. x ⅝in. for the body to rest on. This will raise it above the floor and allow an entrance all along the front.

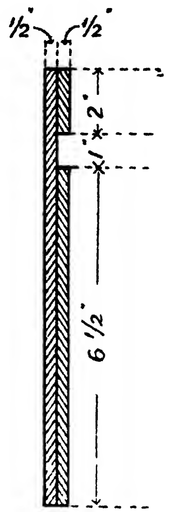
For the body, use the two ends of the case, the top edge being rabbeted, as shown in Figure 4 and metal rabbets nailed on. These can be obtained from any dealer in bee goods. The object of the rabbets being to allow of bees running under the ends of the frames, and also giving less surface for the bees to stick tight with propolis.



Section through AB

Fig. 4.

The sides of the cases are next cut 20½ inches long and nailed on to the two ends. The ends are now ⅞ inch thick and the sides half-inch: half-inch, however, is thin for the sides and does not conserve the heat of the hive as well as ⅞ inch; therefore, nail another thickness of half-inch wood outside this, but not the whole depth of side. The top strip may be two inches wide. Then leave a 1 inch gap; the bottom strip will then be 6½ inches wide. Now nail along the top and bottom of front and back two more 2-inch strips. These will strengthen the joints and the strips along the top will give a good hold all round for lifting the body. To make the method of putting the hive together more plain, the ends of the wood in Figure 3 are shown dark. Figure 4 shows a section through the ends, and Figure 5 through the sides. Figure 6 is a plan. The inside measurements of this hive are 9½in. high x 18⅝in. x 13¾in.



Section through CD

Fig 5

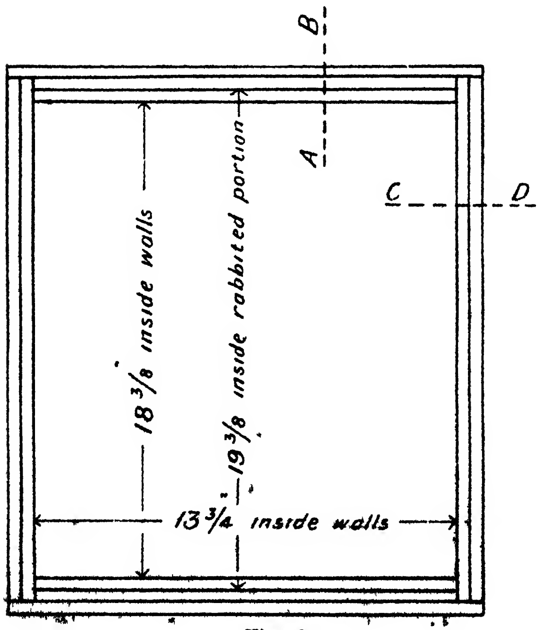


Fig. 6.

The roof can be made of half-inch wood from petrol cases, or if available, thicker wood for preference. The side of a petrol case is the exact length required. Now prepare three strips of 1-inch seasoned jarrah or good white wood, one inch, one and a-quarter inches, and one and a-half inches wide respectively. These form the cross pieces to which the roof is nailed, the one and a-half inch piece in front and the one inch piece at back, thus giving a slight slope to run the water off.

A piece of galvanised iron, 24½in. x 19in., is now obtained, the corners cut and the front and back bent over and nailed to the cover. The sides are bent at an angle of about 45 degrees, but not nailed. This will allow ventilation between the wood top and the iron roof, and will at the same time prevent the rain driving under. Should spiders make their web in this space, it is an easy matter to bend the sides up and clean out the web with a stick. In Figure 3 the visible side is shown bent up for cleaning.

If galvanised iron is not available, a petrol tin may be used. Cut the ends out; cut the remainder down at two opposite corners, so that you have two pieces each composed of two sides of the tin.

These may now be used for the roof, one overlapping the other; the joint being nailed down along the centre cross-piece. The whole should now be painted with two coats of paint, but if tar is available, it is preferable to dip in or paint the floor board with hot tar. The iron roof may be painted with red oxide if desired.

The projecting alighting board, shown in Figure 3, is not suitable for those who move their bees about to catch the honey flow. Figures 7 and 8 show two types of detachable alighting boards.

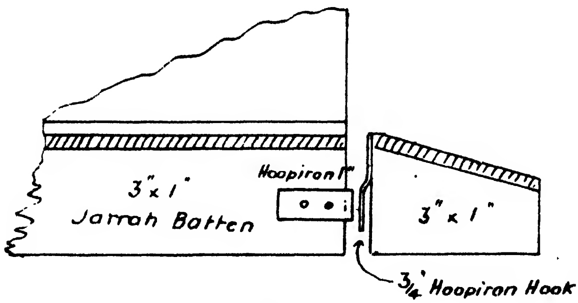


Fig. 7.

In Figure 7 the floor is cut off flush with the front of the hive body and the two clips made of 1 inch hoop-iron, nailed to the front of the 3 x 1 jarrah battens, with the top edge 1½ inches in from the floor. The alighting board has two strips of ½-inch hoop-iron nailed to its battens, being bent slightly so that they will just enter the clips like hooks.

Figure 8 shows the alighting board attached by dowels. Where a number of hives are in use, a jig should be made and the holes bored to the jig so as to make the boards interchangeable. The holes in the alighting board must be made a tight fit, while those in the floor are a loose fit. The dowels should be painted to prevent the absorption of water and the swelling of the wood, which might cause too tight a fit. I have both types in use and prefer the dowel type.

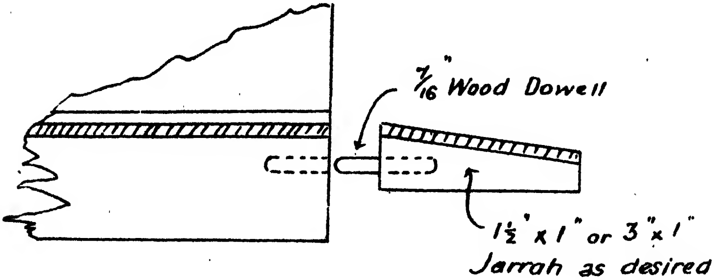


Fig. 8.

Factory Made Hives—

Figure 9 shows a 10-frame factory-made hive of Langstroth pattern with flat cover. Note the dove-tailing of the corners, which makes a thoroughly strong job. These are supplied in the flat and put together by the bee-keeper. Joints should be painted and nailed at every dove-tail with 2¼ inch cement coated nails. These hives can be obtained in either the 8-frame or 10-frame size.

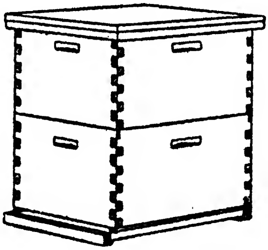


Fig. 9.

In this hive, the tops of the frames are ¼ inch below the top of the body, allowing a bee space over the frames. The bottoms of the frames are flush with the bottom of the body. The bee space and entrance being obtained by ⅜-inch strips on the floor along the sides and back. With this method the bodies can be used either as brood chambers or supers; and is much to be preferred to hives with fixed floors.

Supers for Langstroth hives, whether home made or factory made, may either be full depth 9⅛ inches; half depth, 4½ inches; or ideal, 5⅜ inches, according to the requirements of the district or one's personal preference. The drawback with the ideal size is that ordinary extractors made to take the full depth frame will not take two ideals, whereas it will take two half-depth frames.

A few bee-keepers prefer the Bolton hive. This hive has frames the same length as the Langstroth, but 5⅜ inches deep, that is the same size as for supers. The hive was designed by Mr. Bolton for a special system which cannot be gone into here. Brood chambers and supers are all the same size, and the bodies are fitted with thumb-screws at the sides to tighten the

frames together, thus allowing the bodies to be reversed. It can, however, be used as an ordinary hive without working on the Bolton system by using one, two or three bodies for brood as may be required.

Bottom Boards—

With factory-made hives, these are always separate from the body and I strongly recommend that they should always be kept so, as it is necessary that they should be kept clean. At periods when there is a dearth of nectar, the bees uncap their sealed stores for food and the cappings fall to the floor. This is specially noticeable at the close of winter and the refuse is a fine breeding place for moth grubs. A sprightly moth may dodge the entrance guards and just have time to deposit a few eggs in the refuse before the inhabitants are aware of her presence. If the refuse is thick or the frames too close to the floor, the bees cannot get at the grubs to destroy them and it may be the beginning of the end of the colony.

Manufacturers usually supply bottom boards about ⅞ inches thick. but they only project a short distance in front of the hive and many bees coming home heavily loaded, especially in windy weather, miss this narrow alighting board and fall to the ground; then if there are meat ants about, it is good-bye to the Mistress Bee, but even if there are no ants, the bee will require a considerable rest before making another attempt to reach her front door. I consider that the alighting board should be about 6 inches wide and sloped to run the rain off.

To those who have factory-made floors, I recommend that they should cut these off flush with the front of the hive body, nail them to two strips of 3in. x 1in. jarrah and fit a detachable alighting board, as shown in Figure 7 or Figure 8.

Covers or Roofs—

Many types of covers are in use by bee-keepers. Some use flat, thick wood covers, but these do not weather well and they do not run off the rain.

The Beuhne cover is made of thin wood, covered with a sheet metal roof, packed with newspapers between the wood and metal.

The Ventilated Gable Cover has a wood ceiling and a wooden gable roof, with an air space between the two. One drawback about this cover is that it is a harbour for spiders, which on account of its gable design are difficult to dislodge, also the roof being of wood is liable, unless painted frequently, to weather badly and crack.

A cheap and efficient cover is that illustrated in Figure 3 and is very easy to make. The important thing is to get dried and seasoned wood, so that it does not shrink and allow an entrance for robbers at the joints.

The use of quilts is not recommended, as these rest on the top of the frames and prevent the bees from passing over them. The bees, therefore, stick them to the frames with profolis. Quilts are a harbour for moth grubs, as the bees, however strong, cannot get at them. I am a strong believer in a bee space of ¼ inch to ⅜ inch between the tops of frames and the ceiling.

I occasionally find old-fashioned hives with the gable type of roof and no ceiling or quilt. The great drawback of this type is that there is a space of several inches between the tops of frames and the roof, which the bees frequently fill with comb and honey. When the bee-keeper lifts the cover the comb is broken and there is a lovely mess of honey running down into the hive and drowning hundreds of bees. The difficulty with these covers

can be overcome by making a loose ceiling to rest on the top of the hive, the roof can be placed on this and the air space between the ceiling and roof will keep the hive cool.

When possible it is always best to place hives on stands. In winter the floors keep drier and last longer, and in summer the air can circulate underneath, ants and spiders are not so troublesome and the hives are easier to work as there is not too much stooping.

A good ant-proof stand is shown in Figure 10, and is fully described in the *Agricultural Journal* for September, 1929.

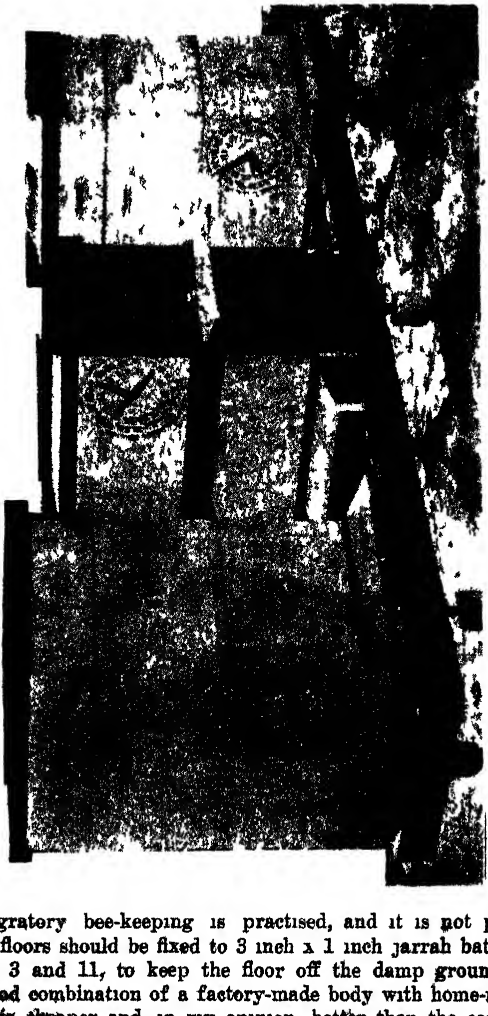


Fig. 10.

If migratory bee-keeping is practised, and it is not possible to use stands, all floors should be fixed to 3 inch x 1 inch jarrah battens, as shown in Figures 3 and 11, to keep the floor off the damp ground. Figure 11 shows a good combination of a factory-made body with home-made floor and cover. It is cheaper and, in my opinion, better than the complete factory made hive.

The dial at the side is a device of my own for recording the condition of the hive at the last examination. The figures show the date and the letters refer to the condition of the hive. A full description of this device was published in the *Agricultural Journal* for September, 1929.

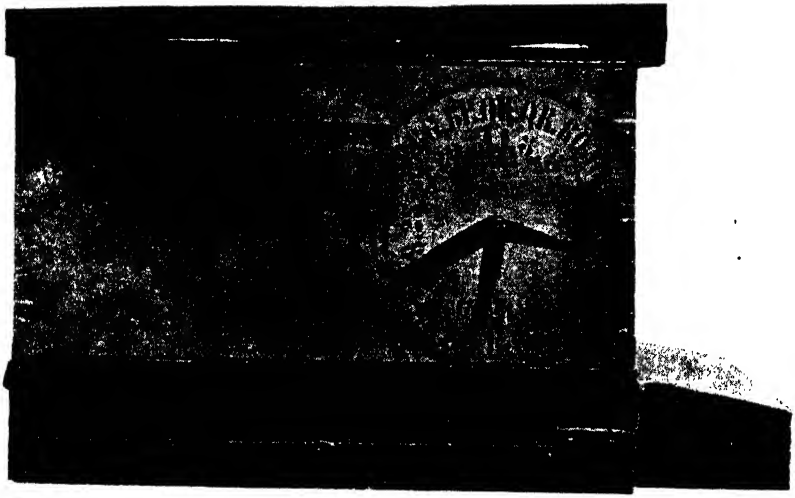


Fig. 11.

Painting—

Paint is a very important part of a hive and much depends on the quality and frequency of painting as to the length of the life of the hive.

All joints should be painted before being put together and nailed, as the joints are usually the first place attacked by the weather. Cement-coated nails should be used whenever possible, as these do not rust and show through the paint like ordinary nails. New hives should have two coats at least of good paint before being used, afterwards one coat every second, third or fourth year, depending upon the quality of the paint used.

As regards the colour, white is that generally used for the whole of the hive, but some bee-keepers that practice migratory bee-keeping and place the hives on the ground, dip the floors in boiling tar or creosote.

There is a tendency at the present time to depart from white and use darker colours. Certainly, a row of clean white hives with a green background, looks very neat and attractive. One rarely in these days sees the roof of a house painted white, for the reason that white absorbs heat and passes it through, whereas red throws off the heat rays. Therefore, the roofs of hives should, whether of wood or iron, be pained with red oxide or some dark colour.

Experiments conducted at the Schleswig Holstein School of Bee-keeping on the drifting of bees from one hive to another, show that bees drift most into hives of the same form and colour as their own, that it is exceptional for them to drift from skeps to frame hives or *vice versa*. It was also

shown that bees prefer hives that are painted yellow, blue or dark colours, or that have their fronts or porches of these colours and that they dislike pale colours and above all, pure white.

Notes made on the numebr of frames occupied by bees at various dates showed that colonies in pale-coloured hives grew weaker, while those in the preferred colour, built up.

I do not say that colour is a very important factor, but the above experiments would go to show that it is a factor, and it is worth while for bee-keepers to try it out. It is quite certain that in a large apiary or in a queen-rearing establishment, it is a great advantage to have hives painted different colours to assist the bees in locating their homes.

TOMATO CULTURE IN WESTERN AUSTRALIA.

E. T. MORGAN,
Vegetable Inspector.

Introduction.

The extensive cultivation of the tomato is of comparatively recent years, but it has advanced so rapidly in public estimation, that large areas are now planted with this wholesome and delicious fruit or vegetable. With our long warm summer, with the mercury sometimes soaring towards 100°, cold lunches with salad are enjoyed by the majority, the tomato takes its true place, as a salad without tomato is like meat without salt.

From available evidence it appears that the tomato originated in Central South America, and it was known and grown by the natives of Mexico, by whom it was highly prized. Apparently it was not used by Europeans as food for upwards of 100 years after its discovery in America, and it was not until about 1870 that it became recognised universally as an important article of diet. It is now regarded by physicians and dieticians as a valuable source of material necessary to good health and proper nutrition. Prices obtained for tomatoes fluctuated considerably, but remunerative returns are generally obtained for a good article, even during glut periods. The grower who puts on the market soiled, grub-eaten tomatoes cannot hope to secure reasonable returns. It is the careful grower who trains his plants, fertilise properly, and effectively combats the attacks of insect pests, thereby producing a good article, who gets a just reward for his labour.

We do have our glut periods, and it is due to the interest and initiative of a well-known Perth firm, which has recently installed machinery for the manufacture of tomato pulp, that steps are being taken to cope with excess production at a certain period of the year.

Prices for early tomatoes are high, and crops harvested in September and October realise anything from £1 to £2 per case. Geraldton and Carnarvon with their early season are first on the market, but quite a large proportion of their crop is exported to the Eastern States, where lucrative prices are obtained.

The production of an early crop is an interesting pursuit as well as a remunerative one, and many growers in the metropolitan area have made large sums of money from relatively small areas. The methods employed are quite simple, but care and attention is necessary to ensure success in this phase of market gardening.

Early Varieties.

Early large red, commonly known as the crinkled variety, is the most suitable for early cropping. Of the smooth varieties Chalk's Early Jewel and Sparke's Earliana are most popular.

Main Crop Varieties.

Chalk's Early Jewel, as well as being a popular early variety, almost takes pride of place as a main cropper. Matchless, Burwood Prize, Ponderosa, Best of All, and Paragon are well-tried and suitable varieties. Dwarf Champion is popular with home gardeners. It is a good bearing variety and does not require staking. The skin is of purplish hue, but unfortunately is inclined to crack. The flavour is excellent.

Selection of Seed.

One of the most important factors in the successful culture of tomatoes is the careful selection of seed. There are many strains of the above varieties, and the careful grower should endeavour to save the seed from his own plantation; also great care should be exercised in its selection. Some time previous to the first picking outstanding plants should be marked. This selection should be made on the basis of vigour, freedom from disease, and the amount and quality of the fruit carried by the plant. The fruit should be well coloured, nice sized, and firm. A good solid tomato is to be preferred to one having soft flesh. Some growers buy fruit from a neighbour, who has grown a good crop, for the purpose of saving seed. This is the next best method to the above-mentioned selection. Obtain seed from a reliable source, and you will have taken the first right step in the production of the tomato crop.

Raising of Plants.

The sowing of seed for the early crop may be carried out from April to July, and some means of protecting them from frosts and heavy rains must be adopted. Some growers prepare the seed bed on the lee side of a building, and place stakes around the bed or curved sticks across it, in order to place hessian covers over the plants at night or during heavy, cold rains. This is risky, and amongst our most successful growers the usual method is to raise the plants under glass. The initial outlay is rather heavy, but over a number of years the cost entailed is justified, owing to the greater surety of raising plants satisfactorily. Artificial heat is generally necessary, and a very successful and economical way of obtaining this is by the use of fresh farmyard manure. Horse manure gives best results; cow manure heats too

slowly, and poultry manure too rapidly. Horse and cow manure mixed together make a good combination; or if horse manure only is obtainable, it should have about one-third to one-half its bulk as straw or fern litter. Mix the whole thoroughly together, watering the heap if necessary, and allow to remain for several days until a good heat has generated. Then take the material and form into a heap 2 to 3 feet high. When the heap has been firmed well down place on it a frame, made as follows:-

Take sufficient light timber to make a box frame about 8 feet long by 5 feet wide, or in that proportion. Make the back of the frame about 2 feet 6 inches high and the front, which should be placed facing the sun, about 18 inches. The glass sashes should be placed on top, a beading being put round the edge of the frame in order to hold the glass in place. If glass is unobtainable, hessian may be used as a covering, but this should be fastened to a roller in order to facilitate the raising and lowering of the cover. The compost heap should be made about 12 inches wider than the frame all round. Seed boxes should then be placed inside the frame. Flat fruit cases are used by the majority of growers and answer the purpose admirably. It is always advisable to obtain unused cases, as if tomatoes have been packed in cases obtained second-hand, there is always danger in using these, owing to the likelihood of disease being carried in them, notably Fusarium Wilt. Soil mixed with stable manure should be used, as it is not advisable to use too much artificial manure with soil intended for seed boxes. Smooth the surface and sow the seeds fairly thickly and cover with a shallow dressing of light soil, sand preferred, and well water, using a fine rose on the watering can, or a fine-nozzled spray pump. As soon as the seeds germinate the sashes should be raised to allow of ventilation. Every living thing must have access to fresh air, and every form of life gives off gases which, if allowed to accumulate, will eventually cause death. Briefly, the hot bed should be ventilated every day. The heat of the bed should never be allowed to become excessive, and should not exceed about 70°. Raising the sashes will cool the bed, and this can be accomplished by placing blocks of wood under the sashes or drawing them back to allow of the circulation of air through the frame. When the plants in the seed box are about 2 inches high, they should be pricked out and transplanted into other seed boxes in the frame and spaced 2 to 3 inches each way. This allows of their making sturdy plants and helps to check "damping off," a disease generally associated with overcrowding in the seed bed. It is also advisable to spray the young plants with a weak Bordeau Mixture, using the formula of 4.4.100, *i.e.*, 4 lbs. of Bluestone, 4 lbs. of lime, and 100 gallons of water. Commercially-prepared forms which are obtainable obviate much time and trouble in this direction. This will tend to check fungal diseases, and the copper solution has a beneficial action on the growth of the plants.

When the plants have attained the height of about 6 inches they will be ready for transplanting. In order to prepare them to withstand the shock of being moved from the artificial conditions of the hot bed to the more rigorous environment of the open air, the plants should be hardened for a week or more before moving. This is done by gradually lowering the application of water; but sufficient water must be allowed to keep the plants alive and strong. The ideal method of hardening plants is to have a structure similar to the hot-bed frame, which is placed directly on to the ground, provided that the land is sufficiently well drained to allow of the free escape of excess water. The plants in the seed boxes should be placed in this, and can be gradually hardened, more effectively than by any other method.

Raising of Plants for the Main Crop.

The seed for the main crop may be planted in the open when danger of frost is over, generally about September and October. The soil is gradually warming up at this period, and if a fairly sheltered spot is picked no difficulty will be experienced in the raising of plants. In some localities slight frosts are experienced during the above months, hence the necessity, in these parts, of choosing a sheltered postition. If, by any chance, plants in the bed suffer from the effects of frost, watering with cold water before the sun's rays strike them will generally save them, as this allows of the gradual thawing of the ice particles and enables the cell-sap to be re-absorbed by the plants. It is the quick thawing of the ice particles that causes the death of the plants, owing to their being unable to re-absorb the sap which has been drawn away from the plant cells by the process of freezing.

The soil of the seed beds should be worked into a fine tilth and about 3 feet wide, leaving a narrow path between to allow of watering and cultivation. The seeds should not be sown too thickly; there should be from 1 to 2 inches between plants. This width enables them to become desirable and stocky plants. The beds should be kept free from weeds and watered sufficiently to keep up a good growth. If at any time the plants are not thriving, watering with a solution of sulphate of ammonia (a large handful to four gallons of water) will encourage growth; but care should be taken not to apply this stimulant directly on to the foliage.

Seed beds are generally made on old cultivated land, and it is a wise plan to fumigate them in order to make sure that certain diseases are not lying in wait for the young plants. Fumigation is carried out quite simply on a small area, and is resorted to by many of our most successful growers.

The method usually adopted is as follows: Using a formalin solution (1 part of formalin to 50 parts of water), the ground should be saturated at the rate of half a gallon per square foot and covered with bags for one or two days. The bags are then removed, the ground is re-dug and left open for two days to allow the fumes to escape. The land is then levelled off and the seeds planted about half an inch deep in rows about 6 inches apart.

(To be continued.)

DISTRICT CHALLENGE SHIELD WHEAT YIELD COMPETITION.

I. THOMAS,
Superintendent of Wheat Farms.

This competition, extending over a period of three years, is not for individual farmers, but for a team of five persons representing the district in which they are located. The award is made upon the best average wheat yield obtained over the total area harvested for grain on the farms of the five competitors. The gross yield is determined by the actual quantity of wheat sold, plus the amount retained for seed, and other purposes, and the average calculated from the acreages, which, in all cases, are measured by the officers of the Wheat Branch, who acted as judges.

In this competition the trophies have been presented by the Cuming Smith Farmers' Fertiliser Co., Ltd., and the Mt. Lyell Farmers' Fertiliser Co., Ltd. The first and main trophy is a challenge shield which is valued at 20 guineas. On the completion of the competition this shield will become the property of the district, Society, or Association nominating the winning team of five farmers. On the shield will be recorded permanently the name of the winning Society and the names of the farmers comprising the team. In addition, the names of the districts who win it in any particular year, together with the names of the individuals comprising the team from that district for that year, will be shown. In addition to this shield, the Fertiliser Companies are presenting the members of the winning team with a small replica of the shield, on which will be inscribed the name of the district winning the yearly competition, and each member of the team.

For the first year of the competition (1928-29) seventeen teams fully complied with the conditions of the competition. This year (1929-30) only twelve of these complied with the conditions and qualified for inclusion as competitors in the third and final year of the competition.

The total area harvested by the twelve teams (60 farmers) during 1929 was 32,741 acres, which yielded a total of 611,192 bushels, an average acre yield of 18 bushels 34 lb.

The detailed results for the second year of the competition are as follows:—

RESULTS.

District.	Members of Team.	Acreage.	Yield. Gross. bus.	Yield. Gross. lbs.	Yield. Average per acre. bus.	Yield. Average per acre. lbs.
Gnowangerup	McDonald, J.	279	10,288	56	36	41
	Willard & Willard	249	7,551	24	30	20
	Formby & Co., Ltd. ...	227	6,652	24	29	18
	Lohoar, W.	292	8,876	...	28	41
	Mouritz, E. A.	200	5,808	...	26	31
	Team average	1,247	38,116	44	30	34
Borden	Booroondara Grazing Co., Ltd.	216	6,000	12	27	46
	Moir, C. C.	220	5,776	28	26	15
	Stone, J. D.	584	15,217	8	26	3
	Murray, W. W.	423	10,772	32	25	28
	Stone, S. G.	231	5,177	...	22	25
	Team average	1,674	42,943	8	25	39

RESULTS—*continued*.

District.	Members of Team.	Acreage.	Yield. Gross. bus.	Yield. Gross. lbs.	Average per acre. bus.	Average per acre. lbs.
Yandanooka	Eckermann, H. W.	257	7,214	52	28	4
	Saunders, W. S.	241	6,735	8	27	57
	Quartermaine, R.	229	5,616	...	24	31
	Smith, H. A.	545	12,760	4	23	25
	Browning, H.	222	4,862	9	21	54
	Team average	1,494	37,188	13	24	53·5
Three Springs	Bastian, A.	333	8,494	...	25	30
	Carter, R., & Son	277	6,997	...	25	16
	Thomas, C. F., & Son ...	526	11,512	12	21	53
	Cousins, A. H.	700	14,204	...	20	17
	Strutton, A. R.	546	10,216	3	18	43
	Team average	2,382	51,423	15	21	35
Moulyinning	Wilson, A. F.	550	12,678	23	23	3
	Mott, C.	249	5,248	...	21	5
	Mott, H.	222	4,619	...	20	48
	Clark Bros.	315	6,014	54	19	6
	Hornsby & Son	344	6,504	20	18	54
	Team average	1,680	35,064	37	20	52
Bruce Rock	Smith, C., & Sons	2,765	56,972	...	20	36
	Ellis, M. P. & E. G. ...	296	5,538	29	18	42
	Garret, G.	697	12,973	28	18	36
	Cusbert, L. C.	559	9,294	44	16	38
	Muntz, J. N., & Sons ...	379	5,839	36	15	24
	Team average	4,696	90,618	17	19	18
Tammin	Nottage, R. B.	249	6,029	...	24	13
	Hocking, H. R.	392	8,041	25	20	31
	Mackin, C.	558	10,454	...	18	44
	Uppill, G.	902	16,157	25	17	55
	Mann, J. W.	609	10,755	...	17	40
	Team average	2,710	51,436	50	18	59
Kulin	Nichols, R.	751	13,662	10	18	12
	Johnston, H. C.	723	12,938	35	17	54
	Trotter, A. W.	464	8,292	22	17	52
	Henderson, J. H.	483	8,572	47	17	45
	Howe Bros.	318	4,710	54	14	49
	Team average	2,739	48,176	48	17	36
Ogilvie	Laurence, H. N.	502	9,467	18	18	52
	Inzard, A.	927	16,382	49	17	40
	Atkinson, A. G.	597	9,839	39	16	29
	Cripps Bros.	600	9,827	5	16	23
	Horan, A. J.	1,429	22,274	...	15	35
	Team average	4,055	67,790	51	16	43
Corrigin	Jenkins, R. M.	586	10,293	24	17	34
	Crossland, J. L.	990	17,053	31	17	13
	Horsman, H., & Son ...	561	9,159	26	16	20
	Fulwood, C., & Son ...	352	5,480	31	15	34
	Jewell, J. D.	602	9,181	21	15	15
	Team average	3,091	51,168	13	16	33
Kukerin	Gard, T.	320	5,135	12	16	3
	Faulkner, W. J.	372	5,874	29	15	47
	Bahr, E. O.	337	5,312	14	15	46
	English, J. C.	931	13,932	32	14	53
	Sugg, M.	434	6,210	55	14	19
	Team average	2,394	36,465	22	15	14
Nungarin	Johnston, J. H	575	8,531	8	14	50
	Creagh Bro	1,060	15,697	0	14	49
	Fitzpatrick, R. C.	783	11,200	48	14	18
	Dawe, S. D.	826	11,669	26	14	8
	Reynolds, A. G.	1,335	13,700	54	10	16
	Team average ...	4,579	60,799	16	13	17

The progressive results of the competition are tabulated in detailed form below. These results are for both the 1928-29 season and the 1929-30 season and show the district teams' averages for the two years.

RESULTS.

District.	Members of Team.	Acreage.	Yield. Gross.		Yield. Average per acre.	
			bus.	lbs.	bus.	lbs.
Gnowangerup—1929 ...	McDonald, J.	279	10,233	56	36	41
	Willard & Willard	249	7,551	24	30	20
	Formby & Co., Ltd. ...	227	6,652	24	29	18
	Lohoar, W.	292	8,376	...	28	41
	Mouritz, E. A. ...	200	5,303	...	26	31
		1,247	38,116	44	30	34
1928 ..	Davis, N. P.	337	9,952	...	29	32
	Parkinson, A. W.	243	7,123	...	29	19
	Garnett, J	200	5,482	...	27	25
	Johnson, A.	332	8,093	...	24	23
	Chambers, E.	292	6,177	...	21	19
		1,404	36,827	...	26	14
Gross Yield 2 years—74,943 bus. 44lbs. Gross acreage, 2 years—2,651. Average per acre over 2 years—28 bus. 16lbs.						
Yandanooka—1929 ...	Eckermann, H. W.	257	7,214	52	28	4
	Saunders, W. S.	241	6,735	8	27	57
	Quartermaine, R.	229	5,616	...	24	31
	Smith, H A....	545	12,760	4	23	25
	Browning, H. ..	222	4,862	9	21	54
		1,494	37,188	18	24	53·5
1928 ...	Neville, P. C. ...	313	9,900	...	31	38
	Saunders, W. S.	238	6,760	...	28	24
	Eckermann, H. W. ...	255	6,452	...	25	18
	Duff, T	302	7,176	...	23	46
	Wick, E. F.	291	6,490	...	22	16
		1,399	36,778	...	26	17
Gross Yield, 2 years—73,966 bus. 18lbs. Gross acreage, 2 years—2,893. Average per acre over 2 years—25 bus. 32lbs.						
Borden—1929	Booloondara Grazing Co, Ltd.	216	6,000	...	27	46
	Moir, C. C.	220	5,776	28	26	15
	Stone, J. D.	584	15,217	8	26	3
	Murray, W. W.	423	10,772	32	25	28
	Stone, S. G.	231	5,377	...	22	25
		1,674	42,743	8	25	39
1928	Milne, M.	257	6,978	...	27	9
	Bungey, R.	332	8,200	...	24	42
	Murray, W.	201	4,900	...	24	23
	McLennan, W., Estate of ..	215	5,220	...	24	17
	Moir, J.	200	4,197	...	20	59
		1,205	29,495	...	24	29
Gross yield, 2 years—72,438 bus. 8lbs. Gross acreage, 2 years—2,879. Average per acre over 2 years—25 bus. 10lbs.						
Three Springs—1929 ...	Bastian, A.	333	8,494	...	25	30
	Carter, R., & Sons	277	6,997	...	25	16
	Thomas, C. F., & Sons ...	526	11,512	12	21	53
	Cousins, A. H.	700	14,204	...	20	17
	Strutton, A. R.	546	10,216	3	18	43
		2,382	51,423	15	21	35
1928 ...	Bastian, A.	283	6,953	...	22	53
	Glyde, K. S.	328	6,806	...	21	4
	Thomas & Sons	567	11,092	...	18	44
	Carter, R., & Sons	353	6,297	...	17	57
	Broad, A. F.	605	9,524	...	16	10
		2,206	41,791	...	18	56
Gross yield, 2 years—93,214 bus. 10lbs. Gross acreage, 2 years—4,588. Average per acre over 2 years—20 bus. 19lbs.						

RESULTS—*continued.*

District.	Members of Team.	Acreage.	Yield. Gross.		Yield. Average per acre.	
			bus.	lbs.	bus.	lbs.
Moulyinning—1929 ...	Wilson, A. F.	550	12,678	23	23	3
	Mott, C.	249	5,248	...	21	17
	Mott, H.	222	4,619	...	20	48
	Clerk Bros.	315	6,014	54	19	6
	Hornsby & Sons	344	6,504	20	18	54
		1,680	35,064	37	20	52
1928 ...	Wilson, A. F.	415	8,715	...	21	0
	Hornsby & Sons	250	5,134	...	20	32
	Clark Bros.	289	4,767	...	16	30
	Mott, C.	461	7,517	...	16	19
	Elder, A.	429	5,960	...	13	54
		1,844	32,093	...	17	24

Gross yield, 2 years—67,157 bus. 37lbs.
Gross acreage, 2 years—3,524.
Average per acre over 2 years—19 bus. 3lbs.

District.	Members of Team.	Acreage.	Yield. Gross.		Yield. Average per acre.	
			bus.	lbs.	bus.	lbs.
Bruce Rock—1929 ...	Smith, C., & Sons	2,765	56,972	...	20	36
	Ellis, M. P. & E. G. ...	296	5,538	29	18	42
	Garret, G.	697	12,973	28	18	37
	Cusbert, L. C.	559	9,294	44	16	38
	Muntz, J. N., & Son ...	379	5,839	36	15	24
		4,696	90,618	17	19	18
1928 ...	Mann, R.	543	9,620	...	17	43
	Heggarty, H. J.	333	5,724	...	17	11
	Stone, S. B.	540	9,170	...	16	59
	Abraham, J. M.	665	10,165	...	15	17
	Tibbs, J. A.	318	4,821	...	15	10
		2,399	39,500	...	16	28

Gross yield, 2 years—130,118 bus. 17lbs.
Gross acreage, 2 years—7,095.
Average per acre over 2 years—18 bus. 20lbs.

District.	Members of Team.	Acreage.	Yield. Gross.		Yield. Average per acre.	
			bus.	lbs.	bus.	lbs.
Kulin—1929	Nichols, R.	751	13,662	10	18	12
	Johnston, H. C.	723	12,938	35	17	54
	Trotter, A. W.	464	8,292	22	17	52
	Henderson, J. H.	483	8,572	47	17	45
	Howe Bros.	318	4,710	54	14	49
		2,739	48,176	48	17	36
1928	Henderson, J. H.	578	13,182	...	22	48
	Johnson & Murray	404	8,202	...	20	18
	Trotter, A. W.	409	7,003	...	17	7
	Nichols, R.	669	11,148	...	16	40
	Howe Bros.	321	4,923	...	15	20
		2,381	44,456	...	18	40

Gross yield, 2 years—92,632 bus. 48lbs.
Gross acreage, 2 years—5,120.
Average per acre over 2 years—18 bus. 6lbs.

District.	Members of Team.	Acreage.	Yield. Gross.		Yield. Average per acre.	
			bus.	lbs.	bus.	lbs.
Tammin—1929	Nottage, R. B.	249	6,020	...	24	13
	Hocking, H. R.	392	8,041	25	20	31
	Mackin, C. C.	558	10,454	...	18	44
	Uppill, G.	902	16,157	25	17	55
	Mann, J. W.	609	10,755	...	17	40
		2,710	51,436	50	18	59
1928	Uppill, G.	963	16,644	...	17	17
	Mann, J. W.	378	7,306	...	19	19
	Thomson, M.	621	9,994	...	16	6
	Mackin, C. C.	829	11,560	...	13	57
	Hocking, H. R.	385	5,718	...	14	51
		3,176	51,222	...	16	8

Gross yield, 2 years—102,658 bus. 50lbs.
Gross acreage, 2 years—5,886.
Average per acre over 2 years—17 bus. 27lbs.

RESULTS—*continued.*

District.	Members of Team.	Acreage.	Yield. Gross. bus.	lbs.	Average per acre. bus.	lbs.
Ogilvie—1929	Laurence, H. N.	502	9,467	18	18	52
	Inzard, A.	927	16,382	49	17	40
	Atkinson, A. G.	597	9,839	39	16	29
	Cripps Bros.	600	9,827	5	16	23
	Horan, A. J.	1,429	22,274	...	15	34
		4,055	67,790	51	16	43
1928	Laurence, H. N.	383	8,590	...	22	26
	Atkinson, A. G.	468	9,156	...	19	34
	Hollis & Browne	425	7,458	...	17	33
	Horan, A. J.	969	15,160	...	15	39
	Carson, P.	825	11,889	...	14	25
		3,070	52,253	...	17	1
Gross yield, 2 years—120,043 bus. 51lbs. Gross acreage, 2 years—7,125. Average yield per acre over 2 years—16 bus. 51 lbs.						
Corrigin—1929	Jenkins, R. M.	586	10,293	24	17	34
	Crossland, J. L.	990	17,053	31	17	13
	Horsman, H., & Sons ...	561	9,159	26	16	20
	Fulwood, C.	352	5,480	31	15	34
	Jewell, J. D.	602	9,181	21	15	15
		3,091	51,168	13	16	33
1928	Sainsbury, C. W.	274	4,920	...	17	57
	Crossland, J. L.	791	13,899	...	17	34
	Bremmer, J. R., & Sons ...	1,124	16,839	...	14	59
	Cronin, J.	671	9,585	...	14	17
	Overheu, W. P.	651	9,302	...	14	17
		3,511	54,545	...	15	32
Gross yield, 2 years—105,713 bus. 13lbs. Gross acreage, 2 years—6,602. Average per acre over 2 years—16 bus. 1lb.						
Nungarin—1929	Johnston, J. H.	575	8,531	8	14	50
	Creagh Bros.	1,060	15,697	0	14	49
	Fitzpatrick, R. C.	783	11,200	48	14	18
	Dawe, S. D.	826	11,869	26	14	8
	Reynolds, A. G.	1,335	13,700	54	10	16
		4,579	60,799	16	13	17
1928	Williams, F. A.	483	8,042	...	16	39
	Dawe, A. F. (estate of late) ...	290	4,738	...	16	20
	Creagh Bros.	916	14,141	...	15	26
	Warner, F. L.	627	8,741	...	13	57
	Payne, H. G.	518	6,113	...	11	48
		2,834	41,775	...	14	44
Gross Yield, 2 years—102,574 bushels 16 lbs. Gross Acreage, 2 years—7,413. Average over 2 years—13 bushels 50 lbs.						
Kukerin—1929	Gard, T.	320	5,135	12	16	3
	Faulkner, W. J.	372	5,874	29	15	47
	Bahr, E. O.	337	5,312	14	15	46
	English, J. C.	931	13,932	32	14	58
	Sugg, M.	434	6,210	55	14	19
		2,394	36,465	22	15	14
1928	Gard, T.	251	3,857	...	15	22
	English, J. C.	808	11,688	...	14	28
	Smith, J.	256	3,221	...	12	35
	Harrison, W.	249	2,991	...	12	1
	Ditchburn, R.	488	5,363	...	10	59
		2,052	27,120	...	13	13
Gross yield, 2 years—63,585 bus. 22lbs. Gross acreage, 2 years—4,446. Average per acre over 2 years—14 bus. 18lbs.						

POTATO CERTIFICATION SCHEME.

Denmark and Young's Siding Districts.

STUD SEED PLOTS RECOMMENDED DURING WINTER MONTHS.

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and

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While on two separate visits to the potato-growing areas of the Denmark-Young's Siding District, with officers of the Potato Branch, during the early part of this year, the writers were very agreeably struck with the fact that the crops grown from certified seed were, in every instance, very much more vigorous and free from diseases—especially those of a "degeneration" or virus nature—than those grown from non-certified seed in similar soil, with the same treatment, in the same district.

Nevertheless, even the best plots of the very best growers showed a certain amount of virus diseases. To remedy this defect, and still further improve the quality of the certified seed, it is very strongly recommended that growers should establish small stud seed plots in the winter time, for the purpose of raising sufficient healthy seed for the growth of the summer crops.

The main point in doing this is that many of the virus diseases, such as "mild mosaic," "crinkly mosaic," "rugose mosaic," and "leaf roll," which are the main causes of degeneration in type and reduction in yield, are to a large extent masked during the summer time by the hot weather. The result is that many of the plants which appear quite healthy in the swamp crops, may actually be infected with virus diseases during the summer without showing any symptoms. In succeeding crops these symptoms may show up, and the consequence will be an ever-increasing reduction in yield, unless special steps are taken to obviate this happening.

"DEGENERATION" OR "RUNNING-OUT" OF POTATO VARIETIES.

In the past it has been the common experience of potato growers in nearly all parts of the world that potato varieties sooner or later "degenerate" to such an extent that they become unprofitable, and a new variety—usually first obtained as a seedling—is then introduced to take its place. As a very large number of other kinds of plants can be propagated vegetatively from buds, cuttings, tubers, corms, grafts, etc., as the case may be, for an indefinitely long period without showing any degeneration in the quantity or quality of the yield, it has always been somewhat of a puzzle why potato strains should more or less rapidly "run out."

Of recent years the explanation has been supplied by numerous scientists who have discovered that the cause of the "running out" is the introduction and spread of virus diseases by means of such sucking insects

Fig. 1.—Healthy Potato Plant. Notice great vigor of growth, abundance of soft foliage, and entire absence of mottling, wrinkling, or rolling of the leaflets. Compare with Figures 2, 4 and 5.

Photo. after W. M. Carne, this Journal, June, 1927.

as aphids, thrips, leaf hoppers, etc. Virus diseases are caused by extremely small parasites, and they cannot be controlled by spraying methods, as the parasites live in the sap of the plants and are therefore quite unharmed by any spray materials which may be applied to the outside. The only practicable control measures are to start off with healthy plants and *keep* them healthy by continuous selection and a rigorous and unceasing campaign against insect carriers.

Fig. 2.—Potato plant with "crinkly mosaic." Photographed to same scale as Fig. 1. Notice mottling and crinkling of many of the leaflets, especially those near the top of the plant. Such plants give considerably lower yields than healthy plants grown under identical conditions, and they act as centres of infection to the healthy plants round about. The disease is spread by means of infected tubers, aphids, and perhaps also by other kinds of sucking insects. Symptoms of the disease show up very plainly in the winter months, but may be entirely obscured during the summer on account of the high temperatures. All such plants should be removed from the "stud plots" and destroyed.

Photo. after W. M. Carne, this Journal, June, 1927.

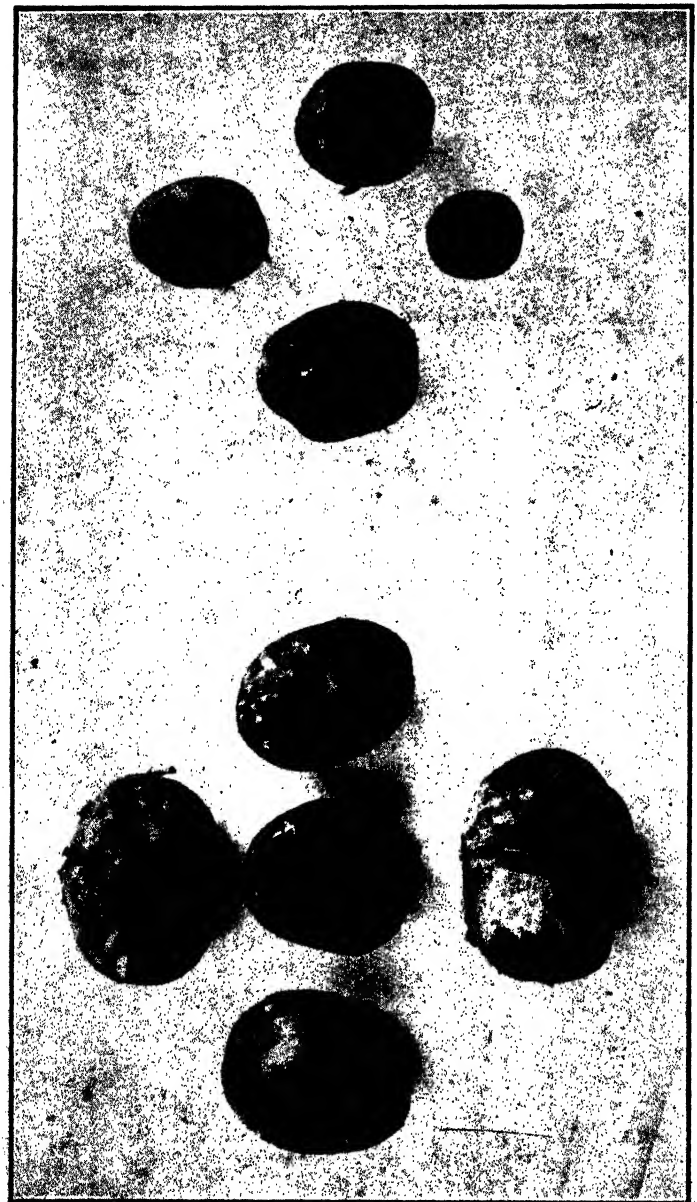

Fig. 3.—A. Potatoes from healthy plant in Fig. 1.

Fig. 3.—B. Potatoes from "crinkly mosaic" plant in Fig. 2.

Photo. after W. M. Carne, this Journal, June, 1927.

PROCEDURE RECOMMENDED FOR ESTABLISHING STUD PLOTS.

Healthy, high-yielding plants can be obtained by selecting apparently-healthy, well-grown plants with a large number of big tubers (not less, say, than ten per plant) from the swamp crop. These should be planted in an

Fig. 4.—Advanced "Leaf Roll" of Potato. Affected plants are usually smaller than healthy ones, and they often have an unusually large number of branches, each, or some of which, bear a number of brittle, thickened, yellowish, sometimes purple-tinted, rolled leaflets. The whole of an affected plant often has a stiff, pale, yellowish appearance, and the rolled leaflets give out a characteristic rattle when the plants are shaken. "Leaf-roll" causes a much more serious reduction in yield than either "mild" or "crinkly mosaic." The disease is carried by aphids or infected tubers. It is not "masked" by high temperatures.

(Photo. N.S.W. Dept. Agric.)

isolated spot during the winter months, and any hills showing mild green and yellowish mottling of the foliage ("mild mosaic"), mottling and crinkling of the foliage ("crinkly mosaic"), very severe mottling, rolling and dwarfing of the foliage ("rugose mosaic"), or brittle, yellowish, rolled leaflets and dwarfing of the plants ("leaf roll"), should be pulled up and destroyed as soon as noticed.

Fig. 5.—Severe form of "rugose mosaic" on Bliss Triumph. Any plants showing such symptoms should be immediately destroyed.

After the photograph by B. F. Dana, in Heald's "Manual of Plant Diseases."

Aphids or other sucking insects should be prevented from spreading the virus diseases within the stud plot, or to the stud plot from the main winter crop, by the use of sulphur and nicotine dust, or "black leaf 40" or other suitable contact sprays. As a matter of fact, aphids and other sucking insects are usually at a minimum during the winter months owing to the low temperatures and high humidity. This fact, combined with the certainty of any virus diseases present in the tubers showing up during the cool winter weather, gives a great opportunity to the growers to very largely eliminate

virus diseases from their stud plots, assuming, of course, that the seed for the stud plot is obtained from the best possible strain of certified seed in the first place.

The stud plot should be very well fertilised, well drained and well cultivated, so that as large a tonnage of seed as possible may be obtained for the subsequent swamp crop from a relatively small, and easily looked after, "stud plot."

Although, theoretically, it would be the best possible plan to save a small amount of the very best seed from the one winter stud plot to establish the winter stud plot of the following year, in practice this is hardly feasible, owing to the great amount of shrivelling and excessively long shoots which normally develop in "Delawares" when stored for such long periods. It would therefore seem advisable to establish a small stud plot at the same time as each of the main crops, irrespective of seasonal considerations, but bearing always in mind that it is only during the cooler months of the year that absolutely effective elimination of "virus-affected" plants can be carried out. For example, the first stud plot planted in March could be dug in July. This would give sprouted seed for planting in the swamps in November and December. This in turn would provide seed for planting in the hills or high land in June or July of the following year. This would provide seed for planting again in December, and so on in like manner indefinitely. (A point that should be borne in mind is that when planting sprouted seed any tubers showing long spindly shoots should be destroyed, as this condition is frequently an indication of "leaf roll.")

In putting forward the above brief suggestions for the establishment of potato stud plots it is realised that the idea is not at all new, as the principle has been advocated from some years now by the officers of the Potato Branch under the leadership of Mr. G. N. Lowe, Senior Potato Inspector, but it is felt that if the growers of the districts mentioned and the neighbouring districts of Elleker and Torbay, etc., adopt the recommendations made above, a considerable further improvement will be made in the already high standard of the certified seed of those districts, which, owing to the good soils of the swamps, relatively high summer rainfall, comparative freedom from insect pests able to spread virus diseases, and the accumulated experience of the certified potato growers as a whole, are rendered eminently suitable to become, for all time, the potato seed nurseries of the State.

PHOSPHATIC LICKS FOR STOCK.

A TRIAL WITH BASIC SUPERPHOSPHATE.

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When investigating methods for remedying Phosphorus Deficiency in stock in South Africa, Sir Arnold Thieler and his colleagues found that precipitated calcium phosphate behaved very like bonemeal.* This information seemed likely to be of considerable economic importance to the stock owners of Western Australia, for precipitated calcium phosphate can be readily prepared by mixing, say, 1 part of lime with 5 parts of superphosphate, or purchased already prepared as basic superphosphate under the trade name of "Basic Phosphate," at a very much lower cost than can sterilised bonemeal. The relative costs being approximately £6 and £20 per ton.

Basic superphosphate (Basic Phosphate), however, in addition to containing precipitated phosphate, contains about 50 per cent. of gypsum—calcium sulphate—a product resulting necessarily from the reaction following the mixture of lime and superphosphate. No information was available as to the effect of this gypsum would have on the animal when ingested as a lick, it might be quite inert or it might be harmful. To obtain information on this point, it was decided to carry out the experiment now being recorded, its object being to determine:

"The harmful effect, if any, of the gypsum in Basic Superphosphate when fed to sheep."

It was decided to conduct the trial at the Avondale State Farm because of its location in the centre of an important sheep raising district, and because of the facilities available. For this trial the commercial basic superphosphate, which contains a registered amount of 17 per cent. phosphoric acid, mainly in the di-calcic form, was used to supply the precipitated calcium phosphate.

The Basic Superphosphate used was the ordinary fertiliser, and not specially prepared for "lick" purposes. In the latter case the lime used for mixing with the superphosphate would contain fewer impurities, mainly sand, than that used for making the fertiliser. The ground limestone used for making fertiliser is about 80 per cent., so that the basic superphosphate fertiliser used in this case as a lick would contain about 4 per cent. sand.

It was calculated that a sufficient weekly ration for a sheep of about 80 lb. live weight, would be supplied by about 2 ozs. of this basic superphosphate; arrangements were made, therefore, to give this to one group of sheep as a weekly dose, and to mix it with half its weight—1 oz.—of stock salt, as the latter would invariably be mixed with the former when used as a "stock lick." Another group of sheep grazing on the same feed, but without any lick to provide a mineral supplement in any form, was used

*Phosphorus deficiency in the Livestock Industry. Page 38 Thieler, Green and Du Toit, 1924.

as a control with which to compare the effect of feeding this mineral phosphatic lick containing gypsum. For comparative purposes, groups of sheep receiving respectively a weekly ration as under—

(1) **Bonemeal 2ozs.; Stock Salt 1oz, and**
(2) **Stock Salt 1oz.**

were also included. Each group consisted of 25 sheep. To secure the necessary number for the four groups, 100 wethers of average size and condition were run off in February, 1929, from a line of North-West store wethers, which had been purchased at Midland Junction saleyards in the previous December for the purpose of being fattened. The sheep were then selected according to age, so that each group consisted of—

6-tooth sheep	**15**
Full-mouthed sheep ...	**10**

The groups were designated A. B. C and D, as under—

A. Group, numbered 1 to 25—Nos. 1 to 10 being full-mouth, Nos. 11 to 25 being 6-tooth.
B. Group, numbered 26 to 50—Nos. 26 to 35 being full-mouth, Nos. 36 to 50 being 6-tooth.
C. Group, numbered 51 to 75—Nos. 51 to 60 being full-mouth, Nos. 61 to 75 being 6-tooth.
D. Group, numbered 76 to 100—Nos. 76 to 85 being full-mouth, Nos. 86 to 100 being 6-tooth.

The treatment decided upon for each group was as follows:—

Group A.—to receive no mineral ration.
Group B.— " " 1oz. Salt weekly.
Group C. " " 2ozs, Bonemeal and 1oz. Salt weekly, and
Group D.— " " 2ozs. Basic Superphosphate and 1oz. Salt weekly.

It was arranged to administer the weekly ration in three equal doses during the week. To enable this to be done, the sheep were yarded on alternate days, excluding Sundays, and in order to ensure that the individual sheep should receive the full amount allotted to it, those receiving a mineral ration were placed in a drafting race, and the allotted 1/3rd. of the weekly ration was poured down their throats through the inverted neck of a bottle.

As the sheep were from the North-West and accustomed to roaming over a wide range under conditions entirely different from those which obtained during the progress of the experiment, and which involved their being yarded thrice weekly, it was considered that their condition might suffer as the result of so much handling. Because of this the control sheep in Group A, receiving no mineral ration, were yarded at the same time as the others. All groups were treated, watered and grazed in an identical manner, except for the difference in the mineral—"lick"—ration and the actual operation of administering it in the case of the control sheep—Group A.

The rainfall during the period of the experiment was as under—

February	**102**	**points**
March	**45**	**,,**
April	**21**	**,,**
May	**284**	**,,**
June	**341**	**,,**

For the first six weeks the sheep were pastured on wheaten and oaten stubble; whilst on this feed they were drinking fresh well-water. Later they were pastured on herbage, which had grown on stubble land, and which had been cropped with oats three years previously. The water supply

Administering the specified dose of experimental lick.

in this paddock was brackish and unsuitable for horses or cattle. Samples from three watering places in the same paddock were obtained in February of this year and analysed with the following results:—

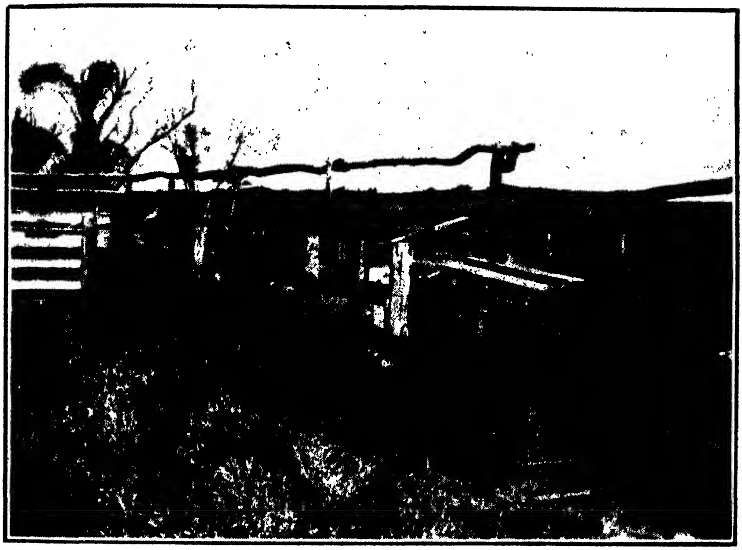
Figures represent grains per gallon:—

——	No. 1. Soak on side of gully.	No. 2. Taken from gully.	No. 3. Taken from soak out from gully.
Total soluble salts	26·46	672·84	588·14
Sodium chloride (calc. from chlorine	15·54	653·59	567·70
Calcium, Ca.	2·87	11·06	17·78
Magnesium, Mg.	3·58	48·79	37·31
Reaction, pH.	7·4	8·2	7·6

All three waters contained an unusually high proportion of magnesium.

These results indicate the quality of the water which the experimental sheep were getting, but in connection with them it must be stated that in February, 1929, the rainfall recorded was 102 points, whilst in February, 1930 the rainfall was only five points.

The sheep arrived on the farm in December and mineral feeding commenced on **February 11th.**



The crate in which the sheep were weighed in accordance with the requirements of the experiment.

The sheep were weighed at the beginning monthly, and at the end of the experiment when they were to be marketed, slaughtered and examined post mortem. The first weighing was made on February 11th, 1929, it had been delayed for a few weeks with the object of allowing the sheep to become accustomed to their surroundings to afford them a chance to recover from the effects of travelling from the North-West. Subsequent weighings were made as follows:—

2nd weighing on March 11th.
3rd weighing on April 8th
4th weighing on May 6th
5th weighing on June 4th

During the progress of the experiment several of the sheep became affected with "Pink Eye," these were removed from the experiment and the previous weighings of these sheep were not included in the average comparisons. The number of sheep in each group was, thus, reduced to Group A, 23 sheep; Group B, 20 sheep; Group C, 19 sheep, and Group D, 21 sheep. The details of the weighings are set out in the following table—

AVONDALE FARM SHEEP FEEDING EXPERIMENT.

Group A.						Group B.					
No mineral ration.						1oz. salt weekly.					
Sheep No.	Monthly weighings. 1st.	2nd.	3rd.	4th.	5th.	Sheep No.	Monthly weighings. 1st.	2nd.	3rd.	4th,	5th.
1 ...	77	76	82	79	82	26 ...	84	79	86	86	94
2 ...	75	76	80	82	82	27 ...	81	76	81	87	81
3 ...	79	79	84	80	82	28 ...	77	74	79	87	82
4 ...	75	69	76	74	78	29 ...	80	72	78	87	79
5 ...	84	81	85	84	87	30 ...	67	68	75	74	74
6 ...	93	85	93	92	91	31 ...	78	84	88	90	94
7 ...	82	78	84	83	85	32 ...	76	82	84	84	87
8 ...	74	72	79	78	82	33 ...	76	76	79	81	84
9 ...	91	85	93	92	96	34 ...	80	76	82	82	87
10 ...	70	75	84	85	85	35 ...	79	80	86	89	86
11 ...	76	71	78	74	79	36 ...	79	76	85	83	90
12 ...	85	82	89	86	93	37 ...	83	77	83	83	84
13 ...	...	...	...	...	...	38 ...	...	...	...	...	...
14 ...	83	76	84	83	87	39 ...	70	71	79	87	83
15 ...	77	81	85	85	86	40 ...	71	75	77	79	84
16 ...	72	73	80	76	80	41 ...	72	71	72	75	76
17 ...	87	77	81	83	82	42 ...	...	...	...	...	...
18 ...	84	85	87	88	92	43 ...	...	...	...	...	...
19 ...	82	80	81	83	89	44 ...	66	66	70	67	74
20 ...	75	70	79	74	76	45 ...	...	...	...	...	...
21 ...	72	71	78	87	79	46 ...	78	76	82	87	82
22 ...	...	...	...	...	...	47 ...	...	...	...	...	...
23 ...	84	78	83	80	79	48 ...	75	68	75	76	81
24 ...	76	73	81	81	80	49 ...	71	71	77	87	86
25 ...	82	73	82	79	85	50 ...	82	81	89	86	92
Totals— (23)	1,835	1,766	1,908	1,888	1,937	(20)	1,525	1,499	1,607	1,657	1.679
Average weight per sheep—	79·8	76·8	83·0	82·1	84·2		76·25	74·95	80·35	82·85	83·95
Percentage—	100	100	108·1	106·9	109·6		100	100	107·2	110·6	112·0

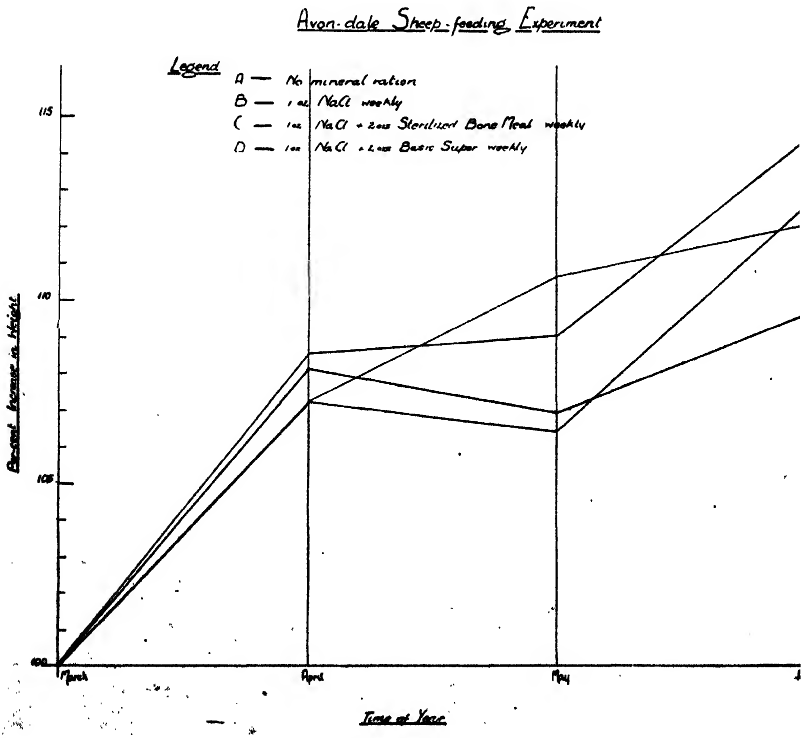
Avondale Farm Sheep Feeding Experiment—continued.

Group C.						Group D.					
2ozs. Sterilised Bonemeal and 1oz. Salt weekly.						2ozs. Basic Superphosphate and 1oz. Salt weekly.					
Sheep No.	Monthly weighings.					Sheep No.	Monthly weighings.				
	1st.	2nd.	3rd.	4th.	5th.		1st.	2nd.	3rd.	4th.	5th.
51 ...	...	...	...	...	...	76 ...	76	71	77	75	83
52 ...	77	76	82	81	86	77 ...	77	78	84	81	88
53 ...	82	80	84	82	87	78 ...	70	69	75	77	81
54 ...	82	79	83	82	86	79 ...	84	80	84	85	87
55 ...	82	76	79	80	84	80 ...	80	80	84	95	88
56 ...	...	...	...	...	...	81 ...	82	80	85	87	88
57 ...	75	69	77	75	80	82 ...	...	...	...	...	...
58 ...	88	85	90	91	94	83 ...	75	74	79	80	83
59 ...	70	67	71	72	76	84 ...	82	76	86	88	94
60 ...	...	...	...	...	...	85 ...	80	73	80	78	81
61 ...	78	69	77	72	79	86 ...	70	69	74	75	80
62 ...	...	...	...	...	...	87 ...	83	75	83	70	89
63 ...	86	79	85	83	87	88 ...	76	74	80	71	84
64 ...	78	77	80	79	83	89 ...	72	66	74	77	76
65 ...	...	...	...	...	...	90 ...	72	66	71	73	78
66 ...	72	74	81	79	75	91 ...	87	84	94	93	104
67 ...	78	65	72	73	76	92 ...	68	65	69	80	77
68 ...	83	83	84	83	89	93 ...	86	85	90	95	87
69 ...	...	...	...	...	...	94 ...	...	...	...	...	...
70 ...	87	69	76	76	83	95 ...	80	79	86	88	91
71 ...	82	72	77	77	82	96 ...	80	73	84	81	87
72 ...	75	72	80	81	89	97 ...	80	72	76	75	80
73 ...	70	68	77	77	81	98 ...	74	70	76	75	76
74 ...	81	77	80	80	89	99 ...	...	...	...	...	...
75 ...	75	72	75	77	80	100 ...	...	...	...	...	...
Totals— (19)	1,501	1,409	1,510	1,500	1,586	(21)	1,634	1,599	1,691	1,699	1,782
Average weight per sheep—	79·0	74·2	79·5	78·9	83·5		77·8	74·2	80·5	80·9	84·9
Percentage—	100	100	107·2	106·4	112·6		100	100	108·5	109·0	114·4

It will be seen from a comparison of these results that at the second weighing all groups had continued to lose weight, thus justifying the delay which had taken place in the first weighing and indicating that the sheep had not even by then become accustomed to their new conditions, and that the date of this second weighing, rather than the first one, should be the initial stage from which comparisons should be made. At the next weighing in April there was a general all-round and about an equal average improvement in the weight of the sheep in each group, as may be seen from the following table, showing the respective average weights at the two weighings:—

AVERAGE WEIGHT IN EACH GROUP.

—	March.		April.	
	lbs.	per cent.	lbs.	per cent.
Group A	76·80	100	83·00	108·1
Group B	74·95	100	80·35	107·2
Group C	74·20	100	79·50	107·2
Group D	74·20	100	80·50	108·5



The differences between these and averages of previous weighings show that there was a general all round and about equal gain in each group.

The respective average results at the April and May weighings were:—

AVERAGE WEIGHT IN EACH GROUP.

——	April.		May.	
	lbs.	per cent.	lbs.	per cent.
Group A	83·00	108·1	82·10	106·9
Group B	80·35	107·2	82·85	110·6
Group C	79·50	107·2	78·90	106·4
Group D	80·50	108·5	80·90	109·0

In no case during this period were the gains of the previous month maintained. Two groups increased their weight, those which received salt only made a gain of 2.6 per cent., and those receiving basic superphosphate made a slight gain or just under ½lb., or .5 per cent. The two other groups lost slightly, and about equal amounts. There is not sufficient data available to explain these divergent results.

During the next period good rains fell, and, in consequence, young green feed became plentiful, with the result that there was an improvement in the average weights in all groups, as is shown in the following table:—

AVERAGE WEIGHT IN EACH GROUP.

——	May.		June.	
	lbs.	per cent.	lbs.	per cent.
Group A	82·10	106·9	84·2	109·6
Group B	82·85	110·6	83·95	112·0
Group C	78·90	106·4	83·50	112·6
Group D	80·90	109·0	84·90	114·4

The greatest and about equal gains were recorded by the sheep receiving bonemeal and salt and basic superphosphate and salt; the least gain was recorded by the sheep receiving salt only. The greater gains with the mineral rations indicate a phosphatic deficiency even in the young pasture, and further apparently confirm the conclusions formed by Sir Arnold Thieler and his co-workers, regarding the necessity for sufficient supplies of phosphorus to ensure that animals make the best use of the feed available.

The results of the second—March—weighing, when the sheep were considered to have become accustomed to their new environment, and the succeeding weighings, are shown in graphic form hereunder.

Forty experimental sheep were sold at Midland Junction Saleyards on 12th June (from Group A, 11 sheep, from Group B, 10 sheep, from Group C, 9 sheep and from Group D, 10 sheep). These were examined *post mortem* at Fremantle abattoirs. Specimens were secured for microscopical examination, the result of the examination of the specimens from various groups did not disclose any marked pathological alteration due to any of the minerals fed. Group D, however, showed slight desquamation of epithelium of mucous membrane of small intestine.

The gains made by all groups from the second weighing, which was the lowest recorded and when the sheep had apparently become accustomed to their unfamiliar surroundings and conditions, are very similar with a slight advantage in favour of the group receiving the basic superphosphate, thus indicating that it had not proved harmful.

SEED TESTING.

RESULTS OF SEED EXAMINATION OF SUBTERRANEAN CLOVER FOR THE PAST SEASON, 1929-30, WITH NOTES ON THE OCCURRENCE OF "SEMI-HARD" SEEDS.

H. G. ELLIOTT, Dip. Agric.,
Assistant Plant Pathologist.

During the past twelve months the examination of all types of agricultural and farm seeds in Western Australia, for purity and germination, has been continued.

In comparing the results of the examination of subterranean clover (*Trifolium subterraneum*) seed for this season with those of the previous twelve months it was noticeable that, whereas last season the germination averaged 62.1 per cent. with 33.6 per cent. of "hard" seeds, this season the germination averaged 70.4 per cent. with 26.9 per cent. of hard seeds, but there was a very unusual occurrence, viz., the finding of "semi-hard" seeds in about 63.0 per cent. of the samples tested.

With reference to the purity of the samples, it can be safely stated that it is on the upward grade; the average purity of the subterranean clover seed for this year was 95.1 per cent. compared with 90.2 per cent. for the last season, or 92.6 per cent. for the seasons 1923-9. There was also a marked decrease this season in the percentage of weed seeds present in samples. The average was only 0.14 per cent compared with 1.63 per cent. for last season, or 0.82 per cent. for the seasons 1923-9.

"Semi-hard" seeds were first noticed in subterranean clover seed in 1928, but only in small percentages. This year, however, they have been remarkably conspicuous, as can be seen from the accompanying tables. It would perhaps be advisable, before continuing, to give a concise definition of just what is meant by "hard" and "semi-hard" seeds.

Hard seeds are normally formed and mature, but do not alter in appearance (remaining inactive for an indefinite period) in a seed bed when placed under the most favourable conditions for sprouting. This hardness is due to the impermeability of the outer skin of the seed preventing the entrance of moisture. All that is necessary to cause germination is to facilitate the access of moisture to the kernel, either by mechanical injury or by softening the skin or outer seed coat.

Semi-hard seeds are intermediate between "hard" and "normal" seeds. They differ from the former in swelling, and from the latter in not germinating in the given time (*i.e.* eight days), unless the outer seed coat or skin has been mechanically ruptured.

The presence of semi-hard seeds in samples of subterranean clover is apparently not confined to West Australian grown and harvested seeds alone, for it will be seen from the accompanying table that they were also present in seeds obtained from South Australia.

RESULTS OF TESTS OF SUBTERRANEAN CLOVER SEED FOR THE SEASON JULY, 1929-JUNE, 1930.

Test No.	Supplier.	Origin.	Purity.	Weeds.	Germination—4 days.	Germination—8 days.	Semi-hard Seeds.	Total Germination.	Hard Seeds.	Actual Value.
			%	%	%	%	%	%	%	
1096 ...	A.	W.A.	93·6	...	37·5	49·0	...	49·0	44·0	45·9
1101 ...	,,	,,	99·0	...	...	29·5	21·0	50·5	45·0	50·0
1108 ...	,,	,,	96·5	...	32·5	49·5	9·0	58·5	37·5	56·4
1120 ...	,,	,,	97·9	...	12·0	21·0	38·0	59·0	35·0	57·7
1121 ...	,,	,,	97·4	Trace	5·0,	22·0	24·0	46·0	37·0	44·9
1122 ...	,,	,,	98·5	,, *	6·5	19·5	48·0	67·5	29·5	66·5
1130 ...	,,	,,	95·1	,,	47·0	51·5	7·5	59·0	11·5	56·1
1135 ...	,,	,,	98·0	,, *	38·0	41·5	14·5	56·0	30·0	54·9
1137 ...	,,	,,	97·0	,, *	4·0	6·5	34·5	41·0	57·5	39·8
Average	...	...	97·0	Trace	20·3	32·3	21·8	54·0	40·7	52·4
1107 ...	B.	W.A.	98·5	...	53·5	63·5	...	63·5	33·3	62·5
1111 ...	,,	,,	97·3	Trace	53·0	58·0	...	58·0	39·0	56·4
1148 ...	,,	,,	89·0	0·6	53·0	61·5	...	61·5	35·0	54·7
1149 ...	,,	,,	94·0	Trace	55·5	68·5	...	68·5	29·0	64·3
1167 ...	,,	,,	97·0	...	85·5	88·0	...	88·0	12·0	85·3
Average	...	...	95·1	0·1	61·1	67·9	...	67·9	29·7	64·6
1092 ...	C.	W.A.	93·0	0·8	18·0	43·5	28·0	71·5	19·0	66·5
1095 ...	,,	,,	94·8	Trace	63·0	70·0	...	70·0	16·5	66·3
1131 ...	,,	,,	87·5	1·0*	50·0	71·5	15·0	86·5	7·0	75·7
Average	...	...	91·8	0·6	43·7	61·7	14·3	76·0	14·2	69·5
1114 ...	D.	W.A.	93·4	...	82·5	95·5	...	95·5	2·0	89·1
1133 ...	,,	,,	95·3	...	46·0	53·0	46·0	99·0	...	94·3
1142 ...	,,	,,	95·0	Trace	30·0	37·0	50·0	87·0	7·5	82·6
Average	...	...	94·6	Trace	52·8	61·8	32·0	93·8	3·1	88·7
1113 ...	E.	W.A.	98·0	Trace	79·5	79·5	...	79·5	20·5	77·9
1129 ...	,,	,,	96·5	...	43·0	49·5	20·0	69·5	27·5	67·0
Average	...	...	97·3	Trace	61·3	64·5	10·0	74·5	24·0	72·5
1132 ...	F.	W.A.	98·1	...	6·5	24·5	35·0	59·5	29·0	58·4
1136 ...	,,	,,	97·7	...	19·0	23·0	29·0	52·0	35·5	50·4
Average	...	...	97·9	...	12·8	23·8	32·0	55·8	32·3	54·4
1123 ...	G.	W.A.	99·3	Trace	...	...	...	...	...	...
1138 ...	,,	,,	95·5	,,	72·0	73·5	10·0	83·5	12·5	79·7
Average	...	...	97·4	Trace	72·0	73·5	10·0	83·5	12·5	79·7
1119 ...	H.	W.A.	97·6	0·8†	38·0	43·5	20·0	63·5	33·0	62·0
1143 ...	I.	W.A.	96·5	Trace*	11·5	15·0	53·0	68·0	25·0	65·6
1094 ...	J.	S.A.	99·0	Trace	2·5	22·5	41·0	63·5	24·0	62·8
1166 ...	K.	W.A.	82·5	...	62·0	72·0	...	72·0	27·0	59·4

* *Romulea rosea* (Guildford Grass) present. † *Bartsia viscosa* (Yellow Weed) present.

SUMMARY.

Suppliers.	No. of Samples Tested.	No. Samples containing Bad Weeds.	Purity.	Weed Seeds.	Germination—4 days.	Germination—8 days.	Semi-hard Seeds.	Total Germination.	Hard Seeds.	Actual Value.
			%	%	%	%	%	%	%	
A. ...	9	3	97·0	Trace	20·3	32·3	21·8	54·0	40·7	52·4
B. ...	5	...	95·1	0·1	61·1	67·9	...	67·9	29·7	64·6
C. ...	3	1	91·8	0·6	43·7	61·7	14·3	76·0	14·2	69·5
D. ...	3	...	94·6	Trace	52·8	61·8	32·0	93·8	3·1	88·7
E. ...	2	...	97·3	,,	61·3	64·5	10·0	74·5	24·0	72·5
F. ...	2	...	97·9	...	12·8	23·8	32·0	55·8	32·3	54·4
G. ...	2	...	97·4	Trace	72·0	73·5	10·0	83·5	12·5	79·7
H. ...	1	1	97·6	0·8	38·0	43·5	20·0	63·5	33·0	62·0
I. ...	1	1	96·5	Trace	11·5	15·0	53·0	68·0	25·0	65·6
J. ...	1	...	99·0	,,	2·5	22·5	41·0	63·5	24·0	62·8
K. ...	1	...	82·5	...	62·0	72·0	...	72·0	27·0	59·4
	30	6	95·1	0·14	39·8	49·0	21·3	70·2	26·9	66·5

The above table shows that, out of the five samples submitted by supplier B, there were no semi-hard seeds present; this was probably due to the conditions being better during the maturing of the seeds, as they were harvested from a different district to the other samples. The percentage of semi-hard seeds in all samples varied from nil-53.0 per cent., with an average of 21.3 per cent.

Out of the thirty samples tested six, or 20 per cent. of them, had present weed seeds which are not desirable, viz., *Bartsia viscosa* (Yellow Weed) in one sample only, and *Romulea rosea* (Guildford Grass) in five samples. The suppliers of these samples were notified that it would be advisable to re-clean them before selling or sowing.

The percentage germination of samples in four days varied enormously —from nil to 82.5 per cent., with an average of 39.8 per cent. A similar variation is noticeable with the total germination, which ranged from 46.0-99.0 per cent., with an average of 70.4 per cent. This is much higher than the germination of the previous periods, 1923-9, as the range for those years was 30.5-92.5 per cent., with an average of 66.2 per cent.

Owing to the enormous variations in the percentage purity and germination of the samples there is consequently the same variation in the *actual value.* To determine the actual value in any seed it is first required to find, in percentage, the purity and germination capacity. For example, if a given sample contains 95.0 per cent. true seed (or purity) which germinates 60.0 per cent., the actual value for use is $95 \times 60 \div 100 = 57.0$, which means that 57.0 per cent. of the seeds of the sample are pure germinable seeds. This will mean that, if the actual cost is, say, 1s. 6d. for 20 lbs., we pay £1 10s. for what is only worth 17s. 1d. (taking the basis of our calculation as perfection); but if we take the standard as 95 per cent. purity and 70.0 per cent. germination, which has an actual value of 66.5, and still allow 1s. 6d. per lb. for 20 lbs., the sample under discussion is worth 57.0 × £1 10s. ÷ 66.5 = £1 5s. $8\frac{1}{2}$d. A certain margin of variation below expectation should always be allowed.

In conclusion it is evident from the analysis of the sample for this season, compared with those of the past six seasons, that—

1. There has been a gradual increase in the standard of purity and germination of commercial subterranean clover seed.

2. There has been a gradual decrease in the percentage of weed seeds present in samples.

3. There occurred this season semi-hard seeds in 63 per cent. of the samples tested. These semi-hard seeds were detected in Western Australian seed for the first time in the 1928 season.

BERSEEM OR EGYPTIAN CLOVER

(*Trifolium Alexandrinum*).

J. T. ARMSTRONG, B.Sc. Agric.,
Senior Agricultural Adviser, Dairy Branch.

Berseem clover is very often called winter lucerne because its upright character of growth is similar to that of lucerne, but its period of growth is during winter, hence the name winter lucerne. This winter growth gives the plant its value to the dairy and pig farmer.

Unfortunately not a very great area in this State is suitable for the growth of Berseem clover, and more unfortunate still is the fact that so little of this valuable fodder is planted where conditions are favourable. Berseem requires a district with early autumn rains, so that planting may be done in February, or by the first week in March at the latest. With an early germination, the rooting system will have developed and the plant be nearly a foot high at least before the cold weather comes in. Unless the young plants are well established before the cold weather commences, all growth will be checked and the stand may die out, or the plants may become very bad coloured and stunted and no further growth will be made until the late spring.

In the karri country, in the Denmark area, Berseem does well, preferring the lighter loam to the heavier class of country, which becomes colder and wetter in the winter. A soil containing plenty of humus is preferred for the following reasons:—

1. Humus improves the physical character of the soil, makes it warmer, more mellow, and easier to work.
2. It improves the water-holding capacity of the soil, and this is of great benefit to the plant in the later stages of its growth when the dry weather is setting in.
3. It makes available plant food, both directly and indirectly—directly from the minerals it contains; indirectly by aiding soil bacteria in their work of preparing plant foods and by the action of acids in dissolving the more insoluble minerals in the soil.

The land should be thoroughly well worked, ploughed early in spring and then harrowed until a fine tilth is obtained, if the area is dry. In Denmark an early crop of maize can be taken off in January, and the land then prepared for Berseem. Where possible, deep ploughing is recommended to allow the roots plenty of soil space, and to ensure that there is no hard pan three or four inches down.

Seed can be broadcast and harrowed or drilled in, using 10 to 12 lbs. per acre if broadcast, and about half that amount if drilled. In the writer's opinion drilling is preferable, because the depth of planting can be regulated, and the manure is put down in the same drill as the seed. If broadcasted, the seed must be covered and the type of mulch will determine the method to be used. Sometimes a T-Bar roller is used, sometimes a light tyne harrow, other times merely a brush harrow. No hard and fast rule can be laid down. The farmer must use the method best suited to his soil. The only set rule is that the seed needs to be covered, but must not be covered too deeply.

Manure generally used is superphosphate at the rate of 2 cwts. per acre, and, if the plants look pale and spindly, a top-dressing of sulphate of ammonia at the rate of 25 to 50 lbs. per acre is given. In the writer's opinion, 25 lbs. sulphate of ammonia is advisable in that it forces the growth and enables the plants to be well advanced before the cold weather sets in.

If planted in February the first cut will be late in May, and the next probably in August, because growth during the winter is slow; but from August to December a cut can be made every month. Cutting should take place when the first flowers are beginning to appear. Well-grown plants are then about 18 inches to two feet high. If the stand is allowed to seed, no further growth will take place; so permitting it to seed should be avoided.

Three demonstration plots were put in by the writer at Denmark last year on holdings belonging to H. Harris, E. Bastiani, and J. Pommeroy.

On Mr. Harris' block the stand was disappointing. The soil was inclined to be heavy; it was new land and had not been sufficiently well worked. This stand was not cut but was grazed off when about a foot high, and gave four grazings.

The stand at E. Bastiani's holding was excellent. The soil was a light karri loam which had been well worked and had been previously cropped. It was seeded at the rate of 10 lbs. per acre; and superphosphate was applied at the rate of 2 cwt. per acre. The first cut was in June and yielded 2½ tons per acre; cut next in September, and gave 5 tons per acre; two other cuts equally as good were obtained, and finally, late in December, it was grazed down.

An equally good stand was obtained at Mr. Pommeroy's farm. The plot had carried maize until late January, and the land was ploughed and then worked down to a fine tilth and seeded on 5th March with 10 lbs. seed and 2 cwt. superphosphate per acre; the seed was harrowed in. In June two tons per acre were obtained, and the second cut in September gave four tons per acre. Subsequent monthly cuts until December gave approximately 3½ tons per acre, until the land became too dry late in December.

These plots yielded from 15 to 20 tons of green fodder per acre.

After cutting in June, and September particularly, a light harrowing gives good returns. The mulch for seeding is fine and is packed down by the heavy winter rains, and harrowing opens up the soil and permits aeration. All plant roots require air for respiration, and leguminous plants need an extra supply to enable the bacteria living in the root nodules to build up nitrates which the plant can use.

Berseem is a particularly valuable fodder plant for dairy cows and for pigs. It is a leguminous plant, and supplies protein to the stock and saves purchasing bran. It is very succulent, and is in this respect more valuable than lucerne.

Sows do extremely well on Berseem; it encourages the flow of milk, thus the suckers get a better start in life, and are ready sooner for the butcher, and porkers and baconers do better with the addition of Berseem to their ration of grain and skim milk.

Summarised briefly:—

Berseem is valuable in districts where it can be sown to germinate by the middle of March at the latest.

Land should be of light loamy character, well drained and warm, containing a good supply of humus.

Good cultivation is necessary.

Seeding should take place early in autumn—February or March.

Manuring should be applied at the rate of 2 cwt. superphosphate and 25 lbs. sulphate of ammonia per acre.

Cover seed lightly.

Cut before the plants have seeded and harrow lightly after cutting, particularly in the winter months.

A light topdressing of superphosphate after each cutting is beneficial.

Berseem may be fed to cows in place of bran.
Increases the flow of milk in sows and aids growth of sucking pigs.
Valuable as an addition to grain for fattening pigs.
Is a leguminous plant and valuable in rotation of crops by improving nitrate content of soil.
Yields of 20 tons per acre can be easily obtained by proper methods of farming, and a big percentage of this is obtained during the winter months when other plants are checked by the cold.
Does well at Denmark, and should do well in the Manjimup area, also in Margaret River and Augusta areas.
Where irrigation for February planting is possible, it will do well even though winter rains are late.
Unless the plants get away early in autumn, no yield can be expected.

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

CATALOGUE OF SCIENTIFIC AND TECHNICAL PERIODICALS IN THE LIBRARIES OF THE COMMONWEALTH OF AUSTRALIA.

Workers in all branches of science in agriculture, in medicine, in the technical and other fields are always handicapped by the difficulties of obtaining the literature necessary for their work. It is manifestly impossible for the private worker to accumulate for himself a library adequate to his needs. The worker in departments or institutions, although in a better position, has constant need to refer to libraries other than his own in order to be able to keep abreast with the literature in his subject.

In Australia, investigators are particularly handicapped by difficulties inevitable in a country where technical libraries are relatively few and distances between them often very great. While these disabilities cannot be completely remedied, they can be considerably reduced by making readily available a catalogue of the contents of these libraries. A publication of this description enables the worker to locate without a waste of time the literature that he requires.

In so far as periodicals are concerned, and it is periodicals that are of paramount importance to the average worker, a catalogue designed to serve this purpose has now been published by the Commonwealth Council for Scientific and Industrial Research. This Catalogue, which has been prepared under the editorship of Mr. E. R. Pitt, of the Melbourne Public Library, includes periodicals (in all languages) of a scientific and technical nature and also the publications issued serially by Government Departments, Institutions and Societies in all countries. In all, 132 Australian libraries have been catalogued. Included in these are the public libraries, the parliamentary libraries, and the libraries of Government departments, of the Universities, the Scientific Societies and Institutions in each State.

A copy of this Catalogue will be found invaluable not only on the shelves of all libraries but also to medical men, technical chemists, engineers, architects, veterinarians, and those engaged in agricultural research, in public health and sanitation matters, and to all classes of builders and manufacturers. Throughout the preparation of the Catalogue special attention has been paid to Australian publications, and it will therefore serve as a record of all periodicals of a scientific and technical nature that have been published in Australia.

THE MERCHANTS' GIFT TO RESEARCH.

THE MERCHANTS' AGRICULTURAL RESEARCH FUND.

GEO. L. SUTTON,
Director of Agriculture.

Shortly after the Hon. M. F. Troy, Minister for Agriculture, announced that it was the intention of the Government to establish an Agricultural College, and that "Muresk" had been purchased for the purpose, the merchants of this State voluntarily started a movement with the object of raising £10,000 to endow one of the activities of the College.

The first step which led to the inauguration of the Merchants' Agricultural Research Fund was taken in 1922 when the writer approached the late Hon. George Swinburne, one of the Trustees of the McCaughey bequest, to ascertain if the trust could make a grant towards the establishment of an agricultural college in Western Australia, at which beneficiaries under the bequest might be trained in agriculture. About that time there were some 20 sons of deceased or incapacitated soldiers in Western Australia to whom it was desired to give such training. After consideration it was decided by the trustees that it was impossible to accede to the request without obtaining a special order from the Victorian Court. Mr. Swinburne, however, was deeply and sincerely interested in the proposal for the establishment of an Agricultural College, and approached the Mt. Lyell Fertiliser Co., of which he was Chairman of Directors, and also invoked the sympathy of Messrs. Cuming, Smith & Co., the only other fertiliser company at that time manufacturing superphosphate in this State. Each of these companies decided to donate £500, and in addition they arranged for the active co-operation of merchants in Western Australia.

The next step was a meeting of the firms acting as distributors for the superphosphate companies, and this meeting decided to call the merchants of Perth and Fremantle together in order to forward this movement. This general meeting was held in the Builders' Exchange on 26th November, 1924, and was presided over by the then President of the Perth Chamber of Commerce, Mr. H. W. D. Shallard. At this meeting it was decided to proceed with the collection of funds, and the following motion, which formally brought the fund into being, was moved by Mr. T. E. Field and seconded by Mr. W. Padbury:—

> "That, with a view to the improvement of agricultural practice in Western Australia, this meeting of Perth and Fremantle merchants is of opinion that a fund should be established for the endowment of scientific research at the Muresk College, the fund to be known as the 'Merchants' Research Fund.'"

At this meeting a resolution moved by Mr. W. Stowe and seconded by Mr. A. Sandover was also carried; this was as follows:—

> "That, except where otherwise directed by the donors, the moneys collected be placed under the control of trustees for investment in Government bonds, the interest therefrom to be devoted to the advancement of scientific research at the Muresk Agricultural College."

Further, an executive committee was appointed at this meeting; those who accepted were Messrs. John Black, T. E. Field, Hugo Fischer, E. F.

Fairey, J. Gemmel, Jas. M. Macfarlane, H. D. McCallum, A. H. Malloch, C. S. Nathan, Wm. Padbury, B. Perry, R. Purser, W. A. Ross, R. Russell, A. Sandover, Professor E. O. G. Shann, Messrs. Geo. L. Sutton, R. Telford, H. J. Wigmore (Chairman), and Wilmott Y. Cooke (Secretary).

Following upon this meeting the committee set actively to work with the result that £9,226 17s. had been collected by the 30th October, 1925; the total collection expenses were £122 9s. 11d., or only 1-1/3rd per cent. of the total. Since then further donations amounting to £605 15s. have been received, so that the total amount donated is £9,832 12s., or nearly the £10,000 which was the goal aimed at.

A meeting of the doners was held on 30th October, 1925, and as arrangements had been made for the donations as received to be invested, the sum to the credit of the fund—the donations with the interest earned—exceeded £10,000. At this meeting of donors a resolution was carried appropriating a sufficient amount of the accrued interest to raise the capital to £10,000; the following resolution was also carried:—

> "That the capital fund be handed over under a proper deed of trust to the West Australian Trustee, Executor, & Agency Co., Ltd., for perpetual endowment of the research work at or connected with the Muresk Agricultural College."

The sum of £10,000 was accordingly paid over to the Trustee Company. At the final meeting of the donors on the 23rd of February, 1926, it was resolved that the Trustee Company be directed to invest the said sum of £10,000 in Western Australian Government bonds; the company thereupon purchased from the Treasurer of the State of Western Australia bonds to the value of £10,000, maturing on the 1st of May, 1947, bearing interest at the rate of £5 10s. per centum per annum, in half-yearly payments on the 1st day of January and 1st day of July each year, until the date of maturity or redemption.

Under the deed of trust a board of advisers consisting of the following members was appointed:—The Presidents of the Perth and Fremantle Chambers of Commerce, the Professor of Agriculture, the Director of Agriculture, and another member to be co-opted by those named. As the result of a wish expressed by the meeting of subscribers in February, 1926, Mr. H. J. Wigmore, who had been acting as chairman of the committee, was co-opted and appointed as chairman of the board of advisers at the first meeting held on 12th January, 1928. Fifteen meetings of the board of advisers have been held periodically as was found necessary. In addition to the Chairman (Mr. H. J. Wigmore), the Professor of Agriculture of the University of Western Australia (Professor Paterson) and the Director of Agriculture (Mr. Geo. L. Sutton) the following gentlemen have also officiated as members of the board:—Messrs. R. A. Cameron, H. S. Bickford, E. S. Lazarus and B. Rosenstamm, representing the Perth Chamber of Commerce, and Messrs. S. T. Edwards and J. W. Bateman, representing the Fremantle Chamber of Commerce.

Though the fund has an annual income of about £550, the board of advisers felt that it was advisable that the interest should be allowed to accrue in order to provide for equipment and other contingencies which would be necessary in addition to the salary of the investigator. Whilst the necessary accumulation of interest was taking place various subjects for research were considered and it was very early decided that the subject for research should

be that dealing with the construction, efficiency, and economy of agricultural machinery, having special regard to the draught of ploughs, mouldboard and disc, as affected by different factors, such as—

Type of plough;
Cross section of furrow;
Depth;
Moisture; and
Previous crop.

This proposal was not proceeded with, as the board of advisers considered sufficient reserves had not accumulated to justify its commencement. In the meantime, as a result of further consideration, and in consequence of the great need which had arisen for pasture research, it was decided that the original proposal should give way to "an investigation (agrostological) in connection with pasture improvement and management."

On the 31st December last the total sum to the credit of the fund was £11,945 16s. 9d. Of this amount the sum of £10,605 15s. was the capital endowment, being £10,000 made up of donations and interest appropriated on 30th October, 1925, and donations amounting to £605 15s. received subsequent to that date. The balance, £1,340, is accumulated interest, and is a reserve from which the annual interest can be supplemented, in order to provide equipment and other essentials for the research worker, for which the annual income after providing for his salary will not be sufficient. The amount of this reserve is now regarded as sufficiently large for arrangements to be made for undertaking the first investigation.

It is desired, if possible, to secure a West Australian research worker, and with this object in view the Principal of Muresk Agricultural College and the writer have been in communication with two graduates of the West Australian University, who are now abroad, one studying in California and the other at Cambridge, with the purpose of securing the services of one of them to undertake this research.

On Monday, 10th March last, after presenting the diplomas at the Muresk Agricultural College, the Hon. H. Millington, then Minister for Agriculture, unveiled a tablet commemorating the endowment of Agricultural Research at the College. This tablet is a handsome bronze one 4ft. 6in. long and 2ft. 6in. wide, mounted on a polished jarrah board, and records in permanent form the names of the donors and also the executive committee who were responsible for the collection of the fund. The names of the donors, and the amount subscribed by each, are as hereunder:—

MERCHANTS' AGRICULTURAL RESEARCH FUND.

Names of Donors and Amounts.

	£	s.	d.
Adams Motors, Ltd.	100	0	0
Aherns, Ltd.	10	10	0
Alston, James and Sons, Ltd.	10	10	0
Anderson, Arthur, Ltd.	20	0	0
Armstrong Cycle and Motor Agency	25	0	0
Arnott, C. W.	21	0	0
Arundel, E., and Co.	50	0	0
Atkins (W.A.), Ltd.	250	0	0
Attwood, Wm.	25	0	0
The Bairds Co., Ltd.	25	0	0
Bales, Arthur, Ltd.	5	0	0
Barton, H. A.	10	10	0
Bateman, J. and W., Ltd.	50	0	0
Boans, Ltd.	500	0	0
Boronia Flour Mills, Ltd.	50	0	0
Bon Marche, Ltd.	10	10	0
British Imperial Oil Co., Ltd.	25	0	0
Brown and Dureau, Ltd.	75	0	0
Burridge and Warren, Ltd.	25	0	0
Bunning Bros., Ltd.	20	0	0
Carter, Charlie, Ltd.	10	10	0

MERCHANTS' AGRICULTURAL RESEARCH FUND—*continued.*

Names of Donors and Amounts.

	£	s.	d.
Castlemaine Brewery, Ltd. ..	25	0	0
Cadd, Frank, Co., Ltd.	5	5	0
Carbarns and Co., D. F. ..	10	10	0
Charles, Joseph	10	10	0
Collins, W. M., and Co.	15	15	0
Corrigin District Farmers Co-op. Co., Ltd.	10	0	0
Cuming, Smith and Co., Pty., Ltd.	500	0	0
Craiks, Ltd.	10	0	0
Crooks and Brooker, Ltd. ..	10	0	0
Dalgety and Co., Ltd.	250	0	0
Denny Bros., Ltd.	100	0	0
Dimmitt, J. A., Ltd.	10	0	0
Distillers Agency, Ltd.	10	10	0
Drew, Robinson and Co. ..	50	0	0
Edwards, H. M.	10	10	0
Elder, Smith and Co., Ltd.	250	0	0
Emu Brewery, Ltd.	50	0	0
Falk and Co., Ltd., P. ..	25	0	0
Felton, Grimwade and Bickford	25	0	0
Fischer, Hugo, Ltd.	100	0	0
Forward, Down and Co., Ltd.	10	0	0
Foy and Gibson Pty., Ltd.	300	0	0
Foy, Jefferson	50	0	0
Ford, Rhodes and Davies ..	21	0	0
Fremantle Stevedoring Co., Ltd.	21	0	0
Gibbs, Bright and Co.	75	0	0
Gilberts, Ltd.	50	0	0
Goldsbrough, Mort and Co., Ltd.	50	0	0
Goode, Durrant and Co., Ltd.	250	0	0
Grave and Dwyer	100	0	0
Great Southern Roller Flour Mills, Ltd.	50	0	0
Harald and Co.	5	0	0
Harris, Scarfe and Sandovers, Ltd.	100	0	0
Hawkins, J. B.	10	10	0
Haynes and Clements	10	0	0
Harold and Murray	5	5	0
Holmes, Richard, and Co. ..	50	0	0
Hodd, Cuthbertson and North, Ltd.	10	10	0
International Harvester Co. of Aust. Pty., Ltd.	100	0	0
Johnson, R., and Co.	5	5	0
Joyce Bros. (W.A.), Ltd. ..	25	0	0
Knight, Digby	21	0	0
Laurie, Capt. R.	10	10	0
Law, R O.	25	0	0
Lazarus, E. S. and Co., Pty., Ltd.	10	10	0
Lalor, T.	5	0	0
Ledger, J. and E.	10	0	0
Levinson and Sons	10	10	0
Learmonth, Duffy and Co. ..	10	10	0
Lynn. R. J.	500	0	0
Macfarlane, J., and Co., Ltd.	20	0	0
Malloch Bros	150	0	0
Makower, McBeath Pty., Ltd.	25	0	0
McCallum, A. C., Ltd.	30	0	0
McKay, H. V., Pty., Ltd. ..	500	0	0
McLean Bros. and Rigg ..	25	0	0
McIlwraith, McEacharn, Ltd.	100	0	0
Millars' Timber and Trading Co., Ltd.	150	0	0
Mitchell and Co. Pty. Ltd.	50	0	0
Moore, Chas., and Co.	10	10	0
Mills and Ware	25	0	0
Mofflin, H. E., and Co., Ltd.	50	0	0
Murray, D. and W., Ltd. ..	100	0	0
Musgroves, Ltd.	20	0	0
Mt. Lyell Chemical Works ..	500	0	0
Narrogin Trading and Agency Co., Ltd.	10	0	0
Nicholsons (1911), Ltd. ..	10	10	0
Nicholls and Co., Ltd.	10	10	0
Paterson and Co., Ltd.	250	0	0
Pearls, Ltd.	5	5	0
Peerless Roller Flour Mills, Ltd.	100	0	0
Perth Motor Garage	10	0	0
Perth Roller Flour Mills ..	100	0	0
Purser, Richard, and Co. ..	150	0	0
Red Castle Brewery	12	12	0
R.M. Co-op., Ltd.	25	0	0
Robinson, John	10	0	0
Robinson and Co., T.	100	0	0
Robertson Bros., Ltd.	10	0	0
Rosenstamm, B.	100	0	0
Sargood Bros.	10	10	0
Saunders and Stewart Pty., Ltd.	21	0	0
Sampson, R. S.	10	0	0
Sainsbury, W. E., and Co. ..	5	0	0
Sewell and Poole	20	0	0
Shearer, John, and Sons, Ltd.	50	0	0
Shearer, David, Ltd.	50	0	0
Sharpen and Riches	10	0	0
Skipper Bailey Motor Co., Ltd.	100	0	0
Stephenson, H. A., and Sons, Ltd.	25	0	0
Stewart Dawson and Co., Ltd.	21	0	0
"Sunday Times"	250	0	0
Swan Brewery Co., Ltd. ..	105	0	0
Thomas and Co., Ltd., W.	100	0	0
Unbehaun and Johnstone, Ltd.	10	0	0
Vetters, Ltd.	5	0	0
Vacuum Oil Co. Pty., Ltd.	15	15	0
Victoria District Co-operative Flour Milling Co., Ltd.	10	10	0
Wagin Flour Milling Co. Ltd.	10	10	0
Westralian Farmers, Ltd. ..	250	0	0
W.A. Rope and Twine Co., Pty., Ltd.	50	0	0
"West Australian" Newspapers, Ltd.	500	0	0
West Australian Boot Co. ..	25	0	0
Weir, J. L. B., and Co.	25	0	0
White, Daniel, and Co.	25	0	0

MERCHANTS' AGRICULTURAL RESEARCH FUND—*continued.*

Names of Donors and Amounts.

	£	s.	d.
Wigmore and Co., Ltd., H. J.	500	0	0
Wills, Henry, and Co.	50	0	0
Wills, W. D. and H. A. (Aust.), Ltd.	25	0	0
Winterbottom Motor Co., Ltd.	100	0	0
Wood, Son and Co., G.	25	0	0
Wunderlich, Ltd.	10	10	0
Wright and Co., Ltd., F. W.	10	10	0
York Flour Milling Co., Ltd.	50	0	0
	£9,832	12	0

In the older and wealthier Eastern States there have not been wanting generous donors who have subscribed most liberally for the purpose of carrying forward the torch of educational and academic progress, and in this State public-spirited men have to a lesser extent, but with the same commendable spirit, helped in the same direction by means of endowments and scholarships. For the merchants collectively to do this is, however, unique in Australia. Indeed, it is very doubtful whether in any other capital city of the Commonwealth such a project would have been entertained, or could have been carried to complete fruition, as has been the case in Western Australia. That it has succeeded is characteristic of the great interest and belief in our agricultural possibilities that is possessed by the mercantile community.

Merchants, as business men, are usually associated with things that are directly useful, and therefore it is a little surprising to find that their gift is to be devoted to research purposes, for research is more concerned about ascertaining the "why" of things than about direct benefits. This attitude, however, shows a keen appreciation of the very real value of research to industry, and is only in keeping with the most advanced views which were very clearly expressed by Sir John Russell, Director of the famous Rothamsted Experiment Station, in an address at Toronto, Canada, when he said:—

> "The nineteenth century took the view that agricultural science was justified only in so far as it was useful. That view we now believe to be too narrow. The practical purpose is, of course, essential; the station must help the farmer in his daily difficulties—which necessitates co-operation between the practical grower and the scientific worker. But history has shown that institutions and investigators that tie themselves down to purely practical problems do not get very far; all experience proves that the safest way of making advances, even for purely practical purposes, is to leave the investigator unfettered. Our declared aim at Rothamsted is 'to discover the principles underlying the great facts of agriculture and to put the knowledge thus gained into a form in which it can be used by teachers, experts and farmers for the upraising of country life and the improvement of the standard of farming.'"

Not only have the merchants been generous, but in providing that their gift shall be utilised for research purposes they have been broad gauged and far-seeing for, as has been shown by the work and results at Rothamsted and other experiment stations, "Research" is the key to agricultural advancement.

Though the research worker in his endeavour to ascertain the "why" of things may be investigating matters which are apparently of no direct value to industry, yet later oftentimes the results have proved of transcending importance. A striking instance of this is the use of mineral superphosphate in agriculture to-day throughout the world. Who could have foreseen the

MERCHANTS' AGRICULTURAL RESEARCH FUND

THIS TABLET

COMMEMORATES THE ENDOWMENT OF AGRICULTURAL RESEARCH AT THIS COLLEGE BY THE FOLLOWING DONORS IN ACCORDANCE WITH THE TRUST DEED DATED 14TH DAY OF APRIL 1927.

Adams Motors, Ltd.
Aherns, Ltd.
Alston, James & Sons, Ltd.
Anderson, Arthur, Ltd.
Armstrong Cycle and Motor Agency.
Arnott, C. W.
Arundel, E., & Co.
Atkins (W.A.), Ltd.
Attwood, Wm.
Bairds Co., Ltd.
Bales, Arthur, Ltd.
Barton, H. A.
Bateman, J. & W., Ltd.
Boans, Ltd.
Boronia Flour Mills, Ltd.
Bon Marche, Ltd.
British Imperial Oil Co., Ltd.
Brown & Dureau, Ltd.
Burridge & Warren, Ltd.
Bunning Bros., Ltd.
Carter, Charlie, Ltd.
Castlemaine Brewery, Ltd.
Cadd, Frank, Co., Ltd.
Carbarns & Co., D. F.
Charles, Joseph.
Collins, W. M., & Co.
Corrigin District Farmers' Co-op. Co., Ltd.
Cuming, Smith & Co. Pty., Ltd.
Craiks, Ltd.
Crooks & Brooker, Ltd.
Dalgety & Co., Ltd.
Denny Bros., Ltd.
Dimmitt, J. A., Ltd.
Distillers Agency, Ltd.
Drew, Robinson & Co.
Edwards, H. M.
Elder, Smith & Co., Ltd.
Emu Brewery, Ltd.
Falk & Co., Ltd., P.
Felton, Grimwade & Bickford.
Fischer, Hugo, Ltd.
Forward, Down & Co., Ltd.
Foy & Gibson Pty., Ltd.
Foy, Jefferson.
Ford, Rhodes & Davies.
Fremantle Stevedoring Co., Ltd.
Gibbs, Bright & Co.
Gilberts, Ltd.
Goldsbrough, Mort & Co., Ltd.
Goode, Durrant & Co., Ltd.
Grave & Dwyer.
Great Southern Roller Flour Mills, Ltd.
Harald & Co.
Harris, Scarfe & Sandovers, Ltd
Hawkins, J. B.
Haynes & Clements.
Harrold & Murray.
Holmes, Richard, & Co.
Hodd, Cuthbertson & North, Ltd.
International Harvester Co. of Aust. Pty., Ltd.
Johnson, R., & Co.
Joyce Bros. (W.A.), Ltd.
Knight, Digby.
Laurie, Capt. R.
Law, R. O.
Lazarus, E. S., & Co. Pty., Ltd.
Lalor, T.
Ledger, J. & E.
Levinson & Sons.
Learmonth, Duffy & Co.
Lynn, R. J.
Macfarlane, J., & Co., Ltd.
Malloch Bros.
Makower McBeath Pty., Ltd
McCallum, A. C., Ltd.
McKay, H. V., Pty., Ltd.
McLean Bros. & Rigg.
McIlwraith, McEacharn, Ltd.
Millars' Timber & Trading Co., Ltd.
Mitchell & Co. Pty., Ltd.
Mills & Ware.
Moore, Chas., & Co.
Moffin, H. E., & Co., Ltd.
Murray, D. & W., Ltd.
Musgroves, Ltd.
Mt. Lyell Chemical Works.
Narrogin Trading & Agency Co., Ltd.
Nicholsons (1911), Ltd.
Nicholls & Co., Ltd.
Paterson & Co., Ltd.
Pearls, Ltd.
Peerless Roller Flour Mills, Ltd.
Perth Motor Garage.
Perth Roller Flour Mills.
Purser, Richard, & Co
Red Castle Brewery
R. M. Co-op., Ltd.
Robinson, John.
Robinson & Co., T.
Robertson Bros., Ltd.
Rosenstamm, B.
Sargood Bros.
Saunders & Stowart Pty., Ltd.
Sampson, R. S.
Sainsbury, W. E., & Co.
Sewell & Poole.
Shearer, John, & Sons, Ltd.
Shearer, David, Ltd.
Sharpen & Riches.
Skipper Bailey Motor Co., Ltd.
Stephenson, H. A., & Sons, Ltd.
Stewart Dawson & Co., Ltd.
"Sunday Times."
Swan Brewery Co., Ltd.
Thomas & Co., Ltd., W.
Unbehaun & Johnstone, Ltd.
Vetters, Ltd.
Vacuum Oil Co. Pty., Ltd.
Victoria District Co-operative Flour Milling Co., Ltd.
Wagin Flour Milling Co., Ltd.
Westralian Farmers, Ltd.
W.A. Rope & Twine Co. Pty., Ltd.
"West Australian" Newspapers, Ltd.
West Australian Boot Co.
Weir, J. L. B., & Co.
White, Daniel, & Co.
Wigmore & Co., Ltd., H. J.
Wills, Henry, & Co.
Wills, W. D. & H. O (Aust.), Ltd.
Winterbottom Motor Co., Ltd.
Wood, Son & Co., G.
Wunderlich, Ltd.
Wright & Co., Ltd., F. W.
York Flour Milling Co., Ltd.

THE EXECUTIVE COMMITTEE RESPONSIBLE FOR THE COLLECTION OF THE FUND £10,000 WAS

JOHN BLACK.	H. D. McCALLUM.	W. A. ROSS.
T. E. FIELD.	A. H. MALLOCH.	R. RUSSELL.
HUGO FISCHER.	C. S. NATHAN.	A. SANDOVER.
E. F. FAIREY.	WM. PADBURY.	GEO. L. SUTTON.
J. GEMMELL.	B. PERRY.	E. O. G. SHANN.
JAS. M. MACFARLANE.	R. PURSER.	R. TELFORD.

H. J. WIGMORE, Chairman.

WILMOT COOKE, Secretary.

Tablet unveiled at Muresk, 10th March, 1930, by the

effect of Liebig's research work when he discovered in 1840 the action of sulphuric acid on bones, and its subsequent extension to mineral phosphates by Lawes and Gilbert in 1842? The result to us is superphosphate as we know it to-day in Australia. Who is bold enough to say that the development following upon the discovery of Liebig, viz., the commercial manufacture of superphosphate, is not the greatest of the benefits conferred upon Australian agriculture?

Another striking instance, and this in a different field, is that of the discovery of the Babcock method of testing milk. Here, as the result of patient research work in the laboratory, a method which revolutionised the butter industry and made it possible to place it upon a sound commercial footing was given freely to the world.

Finally, of numerous other instances, let us not forget the work of those research workers, the early wheat breeders, Wm. J. Farrer, Hugh Pye and Richard Marshall, who, as the result of their great unostentatious work (sometimes ridiculed because not understood) have added so much wealth to our wheat farmers and extended so widely our wheat areas.

Truly has it been said of research that—

> "The agriculture of whole sections of our country, upon which the livelihood of many thousands of people depends, may be entirely changed by experiments in an attic laboratory or by the work of a single man in his own back garden."

The Merchants' Agricultural Research Fund was brought into being by the spirit of National service, its motive is altruistic. Research in the past has, however, conferred benefits in unexpected directions, and agriculturists, whom this fund was designed to benefit, I am sure, will be pleased if the benefits prove to be reciprocal. In this connection it is hopeful to recall further words of the great Liebig, who, in his epoch-making address to the Chemical Section of the British Association for the Advancement of Science stated:—"Perfect agriculture is the true foundation of all trade and industry —it is the foundation of the riches of States."

Less than two decades ago, the wheat lands East of Meckering were not established, it is less than a decade since the possibilities of our Dairy Belt were realised. Having discovered our agricultural lands, it is now our duty to develop their productivity. The merchants' gift to "Muresk" will assist this to be done.

HORTICULTURAL NOTES.

GEO. W. WICKENS,
Superintendent of Horticulture.

APPLES.

In spite of the dry summer experienced fruit buds are numerous, plump and healthy-looking on all varieties of apple-trees, and following on the light crop of season 1929-30 there is every reason to expect a heavy yield in 1930-31. Pruning will be in full swing when this Journal appears in June, and I will again offer the advice given in the March issue to prune fruiting wood heavily as one of the essential steps to take towards preventing an overcrop of under-sized fruit.

At time of writing—May—there are still a few small lines of apples being shipped to Java and Singapore, but the bulk of the export finished in April, and the total is meagre when compared with that of 1929. In that year 821,014 cases were sent away from Western Australia, 160,000 to the Eastern States and the balance to countries outside of Australia. From 1st January to 30th April this year the quantity exported only amounted to 145,776 cases. Of these Great Britain received 26,001 cases, the Continent of Europe 98,505, and the remainder were distributed amongst Singapore, Java, Port Said, Colombo, and Bombay. Returns to hand at present do not cover enough of the season to show how the prices obtained will compare with last year's, but it is pleasing to learn from the Agent General that the fruit on the first boats was in a much superior condition this season to that received on the first boats in past seasons, and shows that the lesson we have learned of the folly of shipping immature fruit is having a good effect.

The light crop this season is not the only feature, unfortunately, which apple growers will carry forward as an unpleasant recollection, 1930 having also the distinction of being the year when we first definitely ascertained that Apple Scab—*Venturia inequalis*—was present in the State. So far only two orchards are known to be infected, but it is quite possible, in fact probable, there are others where the infection is so slight as not to have been noticed, but where it may show up next spring, and should it appear it must be fought vigorously, for when it obtains a firm hold it is one of the worst diseases that apple growers have to contend with. The subject is fully dealt with by the Plant Pathologist in this issue of the Journal.

PEARS.

The pear crop in season 1929-30 was a good one, and would have been much heavier if Pear Scab—*Venturia pirina*—had not severely damaged the fruit in many orchards. The in-and-out results obtained by spraying with the same mixtures in different orchards by different operators were again most noticeable. Some growers suffered no commercial loss after thoroughly spraying once only with the 6-6-50 formula (6 lbs. bluestone, 6 lbs. freshly burned lime, 50 gallons of water) at the pinking stage of blooming; while others in the same district who state they applied the same spray at the same time had nearly 100 per cent. of the fruits badly damaged. In following this matter for several years past I have noted

that in orchards where successful control, as stated above, has been obtained, trees which have been left unsprayed (sometimes intentionally sometimes inadvertently) have invariably carried a big percentage of infected fruit, showing there was no special immunity from the disease in those orchards, and that the different results obtained in places where spraying was ineffective must have been due to a difference in the time or the method of application. In some instances, last spring, spraying with lime sulphur at a strength of 1 in 40, after the fruit had set, did considerable damage in causing the fruit to fall, and it is evident that if hot weather is experienced either at, or shortly after, spraying, lime sulphur at the strength named is dangerous. If the first spraying with Bordeaux 6-6-50 has been thoroughly applied, it is better to risk some loss with scab than use lime sulphur in warm weather for a second spray. Anything over 75° F. shade temperature is dangerous.

The quantity of pears exported from Western Australia from 1st January to 30th April amounted to 22,090 cases, Great Britain receiving 13,834, Europe 7,848, and the balance of 408 was sent to Java and Singapore.

CITRUS FRUITS.

In spite of the dry summer orange trees in most orchards have carried their fruit well, and while the total number of cases produced will be somewhat less than was anticipated earlier in the season owing to the fruit, particularly Valencias, being smaller than usual, I think the crop will amount to 240,000 cases, which, if obtained, will be above the average annual production by about 34,000 cases.

The mandarin crop I estimate at 14,000 cases—a little below the average—and the lemon crop about normal, with 55,000 cases.

GRAPES—FRESH AND DRIED.

The crop of table grapes for season 1929-30 has been good, and the quality likewise. From 1st January to 30th April 39,925 cases were exported to overseas markets, Colombo receiving the most with 18,135 cases, Great Britain next with 11,500, Singapore 5,173, and the balance of 5,117 was divided amongst Java, Bombay, Port Said, Hamburg, and Rotterdam. Further consignments have been despatched to Colombo, Singapore, and Java during May, and the season's total export will be well over 40,000 cases.

In dried vine fruits currants are Western Australia's principal production. This season the lack of rain in summer has favoured successful drying, and the quality is particularly good.

From 10th March to 28th April 627 tons 19 cwts. of currants and 97 tons 6 cwts. of lexias were shipped from Western Australia to Great Britain.

SELECTING THE BREEDING EWES.

HUGH MCCALLUM,
Sheep and Wool Inspector.

There are many farmers who do not realise the importance of the ewe in building up a flock to the ideal aimed at by the breeder. It is essential that they should be carefully selected for their requisite qualities. Leading characteristics which a ewe should possess are, first and foremost, constitution, conformation, trueness to type, vitality, fertility and good bone.

The following are detailed points of a good serviceable ewe that can be purchased, off shears, every year from the leading breeders in the State:—A well-shaped head; a broad and full forehead; clean open face; a mouth without defect; neck of fair length to enable the animal to feed comfortably, being well set in at the shoulders and tapering to the head; shoulders full and deep, with a good depth and width through from shoulder to shoulder to give plenty of room inside for the vital organs to do their work properly; withers full and rounded, the back even and straight and not too long; good bone in the legs: strong springy pasterns, good hocks and fetlocks. Constitution is the foundation of the animal.

When both ewes and rams are selected. with proper regard to strong robust constitutions, this characteristic is disseminated throughout the flock, and results in strong, healthy progeny, if the holding is not over-stocked or the flock underfed. A study of the pastures is essential and the progress of the stock must be watched. With sound vitality, the ewes can stand reverses, but should be looked after, especially during gestation and at lambing-time. Fertility is essential; no ewe that has failed to produce lambs should be on the farm. There are too many unproductive ewes retained on the farms, year after year, for reasons difficult to understand.

If the ewes are not classed every year, the undesirable sheep will retard the flock's improvement. Ewes with any of the following faults should be culled out—broken or defective mouth; weak constitution; showing the grip; scraggy necked; weak shoulders; slab-sided; narrow hind-quarters; thin bone; faulty udder; defective hocks or fetlocks; narrow-chested; tucked-up appearance or deformed sheep; and all animals growing wool that is uneven, dull, yellow-coloured, heavy conditioned or very short in length of staple.

In building up a flock every endeavour should be made to secure a good line from a well known sheep-breeder, off shears, known as cast for age ewes, not cull *ewes* of sound mouth. Broken-mouthed sheep, even though they are cheap, should never be purchased, as they are always a trouble to the purchaser. It is wise not to bargain unduly over the price required by the vendor, bearing in mind the time, cost and work involved in breeding up a high-grade uniform flock. By starting on sound lines many years of

patient work in selecting, mating, breeding and culling are saved; besides the usual disappointments the breeder experiences. Success or failure will then depend entirely on the farmer's own ability in selecting the rams required, mating them with the most suitable ewes, feeding the flock (a most important part of sheep husbandry that must not be neglected), and in attending to the ewes during the gestation period and at lambing time.

Should the farmer purchase ewes at the sale yards, he should be there early in order to have ample time to go through the different lines to be submitted. There may be several lines on offer not suitable to the particular class of country for which they are required. Many buyers of sheep do not examine the lots they are likely to purchase; more attention should be given to this.

There will always be sheep that require to be rejected from purchases made at sales. These sheep should be picked out and fattened as speedily as possible and sold for mutton. The flock will thus be made more uniform.

Before the flock of ewes is shorn, there is another opportunity for culling when they are carrying their full fleece. The ewe hoggets should be culled heavily, and any ewe about which there is any doubt should be rejected. It is upon the young ewes that the farmer is depending to build up his flock to be a credit to himself and the State.

Western Australia is fortunate in having many enthusiastic stud-breeders, and it is largely to the work of these men that the sheep industry owes its success.

Thousands of pounds have been spent in the purchase of the highest grade sheep for breeding purposes, and by skill and perseverance they have built up flocks of a high standard. From them the ordinary farmer can procure sheep from which, by careful selection and mating, he can breed up a high-grade flock or improve his existing one.

No heed should be taken of the low prices for wool or sheep—things will right themselves again after occasional set-backs and disappointments.

May we never lose enthusiasm in continuing to purchase and to breed from only the best sheep obtainable.

POTATO GROWING—CONSIDERATIONS OF SEED.

W. E. COLLINS,
Inspector of Potatoes.

Large and Small Seed.

In order to ascertain what size of seed will give the maximum net yield per acre under given conditions, many points must be considered. The conditions of cultivation are of primary importance; the climate in determining the duration of the growing period must have its effect; the health of the stock will have its influence, while the spacing of the sets in the furrow is also of considerable importance.

On the other hand it has been clearly established by workers in England, Germany and America, that the use of normal seed—those weighing about 2 ozs.—is amply justified, and that the planting of larger or smaller setts is called for only under special circumstances. Assuming the stock to be healthy, small setts do not give the plants such a good start as the larger ones, and there is no doubt that in times of drought large setts have a distinct advantage in that they provide a convenient source of water to the plants, water absorbed by the sett from the soil.

Recent experimental work in this direction, conducted in conjunction with the potato fertiliser trials at Benger Swamp and where drought conditions prevailed, demonstrated most markedly the above fact. Six plots each of setts weighing respectively 1 oz., 2 ozs. and 3 ozs., were planted and progress of growth noted. The plants from the 3 oz. setts were quite outstanding in size and vigour throughout the growing period, the 2 oz. setts less so, and the 1 oz. setts least of the three.

On digging, a corresponding difference in yield was tabulated—the 3 oz. setts yielding approximately 4½ tons per acre, the 2 oz. setts 3½ tons per acre, and the 1 oz. setts 2½ tons per acre.

The larger the sett the more stems there will be, and consequently the greater number of tubers set to each plant. However, if there are too many stems to a plant, and consequently too many tubers are set, few of them will reach "ware" size. Hence the objection to setts that are too large, aside from the greater cost.

It is important to know the most economical distance apart to plant the setts, so as to get the largest yields with the least amount of seed. The net average yield in experiments considered over a period of eight years in America, was greatest from the setts planted in rows 2½ feet apart with the setts 14 inches apart in the rows, though those planted 12 inches apart yielded nearly the same.

The results of five seasons' tests in England warrant the conclusions that planting at from 12 to 14 inches apart, and 30 inches between the rows, is likely to give better yields, and a more uniform grade of ware potatoes, than planting at wider distances.

The practice of the Potato Branch in their experimental work, is to plant 2 oz. setts 15 to 18 inches apart, and 30 inches between the rows. Over a period of three years an average yield of 7¾ tons per acre was noted.

It would seem that a safe general rule to follow in planting potatoes is to increase or decrease the distance between the rows, as well as the setts, in accordance with the size of the seed used, the fertility of the soil, the moisture holding capacity, and the average normal rainfall that may be expected when the plants are developing their tubers. The nearer the soil and weather conditions approach the ideal the larger the seed, i.e., up to 2 oz., and the closer the planting.

The weight of seed planted in the different potato growing areas of the State varies from 8 cwt. to 18 cwt. per acre, the average being 12 cwt.

In order to afford a ready reference to the actual quantity of seed required to plant an acre with setts of definite weights at a given distance between plants, a table has been prepared to cover setts ranging from one to two ounces in weight. It will be noted that plantings made at close intervals with setts ranging from 1¼ to 2 ozs. requires quantities of seed very greatly in excess of those ordinarily used. On land well supplied with organic matter, an abundant supply of available plant food, and moisture, the use of large setts from 1½ to 2 ozs. in weight will prove a profitable investment.

WEIGHTS OF SEED REQUIRED TO PLANT AN ACRE OF POTATOES AT DIFFERENT SPACINGS WITH SETTS OF VARYING WEIGHT.

Distance between Rows and Setts.	1oz. Setts.	1¼oz. Setts.	1½oz. Setts.	1¾oz. Setts.	2oz. Setts.
	T. C. Q. L.	T. C. Q. L.	T. C. Q. L.	T. C. Q. L.	T. C. Q. L.
ROWS 24IN. APART—					
12in. spacing	0 12 0 17	0 15 0 21	0 18 0 26	1 1 1 2	1 4 1 6
14in. spacing	0 10 1 7	0 12 3 16	0 15 1 25	0 18 0 7	1 0 2 14
16in. spacing	0 9 0 23	0 11 2 0	0 13 3 7	0 16 0 13	0 18 1 18
18in. spacing	0 8 0 12	0 10 0 15	0 12 0 18	0 14 0 21	0 16 0 24
ROWS 26IN. APART—					
12in. spacing	0 11 0 5	0 13 3 6	0 16 2 8	0 19 1 9	1 2 0 10
14in. spacing	0 9 1 14	0 11 2 24	0 14 0 7	0 16 7 17	0 18 3 0
16in. spacing	0 8 1 14	0 10 1 24	0 12 2 7	0 14 2 17	0 16 3 0
18in. spacing	0 7 1 13	0 9 0 23	0 11 0 5	0 12 3 15	0 14 2 26
ROWS 28IN. APART—					
12in spacing	0 10 1 7	0 12 3 16	0 15 1 25	0 18 0 7	1 0 2 14
14in. spacing	0 8 3 2	0 10 3 23	0 13 0 17	0 15 1 7	0 17 2 4
16in. spacing	0 7 3 7	0 9 3 2	0 11 2 25	0 13 2 20	0 15 2 14
18in. spacing	0 6 3 14	0 8 2 10	0 10 1 7	0 12 0 3	0 13 3 0
ROWS 30IN. APART—					
12in. spacing	0 9 2 8	0 11 3 24	0 14 1 12	0 16 3 0	0 19 0 16
14in. spacing	0 8 0 14	0 10 0 17	0 12 0 21	0 14 0 24	0 16 1 0
16in. spacing	0 7 1 0	0 8 4 7	0 10 3 14	0 12 2 21	0 14 2 0
18in. spacing	0 6 1 14	0 7 3 26	0 9 2 9	0 11 0 20	0 12 3 0

Cut and Whole Seed.

Whether the grower should plant whole or cut seed depends largely upon the conditions under which he is operating. There are planting months, viz., December and January, that make the use of whole seed almost necessary. Benger Swamp, for instance, planted during January, when temperatures

ranging from 90deg. to 106deg. often prevail, would readily destroy cut seed. Again, where moisture is deficient, cut seed will germinate very irregularly, since the moisture from the cut sett is taken out by the hot dry soil, thus destroying the seed. But where reasonably cool temperatures obtain, and there is sufficient moisture in the soil to enable the potato plant to get a good start, cut seed will be as satisfactory, or even more satisfactory than whole seed.

The chief objections to the planting of whole seed are—first, the number of undesirables that creep in, even where the grower is careful, and the tubers are from a good crop—undesirable inasmuch as they are from weakly plants and cannot be productive; secondly, whole seed potatoes are apt to produce a number of stems to the plant, and these compete among themselves for the available food supply and moisture. The result is a large number of small-sized potatoes, and the percentage of these from the area planted with whole seed is much higher than from that planted with cut seed. The ideal number of stems to a plant is from one to two.

Cut seed may be planted immediately after cutting, or it may be kept for several days. In the latter case our wet bag method, as outlined in previous issues of this Journal, should be adopted. Prolonged delay in planting after the seed has been cut, without this treatment, lowers the vitality of the seed and reduces the yield.

Experiments conducted by the Potato Branch over a period of three years, demonstrated the fact that the balance of yield in favour of treated seed was approximately 2 tons per acre. The "wet bag" treatment is quite simple, but apparently of great importance to potato growers. Numerous reports of the successful application of this method, which has been advocated by this Branch for some time, have been received. These reports all indicate that the "wet bag" treatment of seed or its modification in the case of greened sprouted seed, increases the subsequent crop.

As a preliminary the seed is emptied out of the bags, and the bags are then thoroughly soaked in water; cut the tubers (if unsprouted, as is general in South-West districts) into the bags, and then leave in a cool place for a period of 24 to 48 hours prior to planting, or until such time as it takes for the surface to callous over. To minimise the risk of injury to the sprouts, advanced or well sprouted seed should be cut into boxes, covering same with wetted bags. It will be found that a layer of suberin or corky material has formed over the cut tissues. This layer stops the leaching of cell sap from the cut surface, and also prevents the ingress of harmful soil bacteria or fungoid troubles into the sett.

Each cut sett must contain at least one eye. The value of such setts, however, would appear to be more dependent on their size than on the number of eyes they possess. An examination of some experiments made to determine the value of eyes taken from different parts of one healthy tuber reveals the fact that there exists no consistency in the results, hence it may be concluded that there is no particular portion of a healthy tuber which is more suited for seed purposes than the remainder.

Stem ends have always been regarded with suspicion by growers. They start to grow more slowly and very often produce weak and unproductive plants.

Differences in yield trials between crown and stem ends may be accounted for by the dominance of the crown sprouts. If the tubers be cut sufficiently early their dominance will be destroyed, equally strong sprouts will develop on each portion and the capacity for yielding on each will be similar. Again should the tubers be sprouted, removing the crown sprouts will induce the remaining eyes to bud almost immediately and with equal strength. Removal of sprouts, however, is undesirable and should be avoided.

The tubers should be cut so as to make "blocky" rather than wedged-shaped sets. The advantage of a "blocky" set is less likely to decay in the ground if the weather conditions are unfavourable, and it offers less cut surface to the damaging effect of fertilisers at the time of planting.

Mature and Immature Seed.

Many experiments have been conducted to test the relative values of what is called mature and immature seed. There is very little difference under average conditions as they obtain in our potato growing areas. Well matured, disease-free tubers, kept under proper conditions will make good seed and produce satisfactory yields.

Immature seed—that is, tubers that have not attained their full growth at digging time—will usually not keep well. Such tubers are subject to bruises, and the skin peels readily, thereby inviting the well known storage disease of "Black Spot" or storage trouble of potatoes. Adverse storage conditions are more apt to injure such seed than seed that is ripe. Further, the question of maturity is only a relative one. It is said that a tuber is ripe when the skin adheres closely and does not peel in handling. A tuber assumes this character when growth is checked by an attack of Early Blight (the cause of "Storage Trouble"), or as in the case of our summer plantings when early winter rains set in and arrests the natural maturing of the crop, in consequence a premature ripening is the result in both instances. One advantage of using immature seed is its comparative freedom from disease, due to the fact that a crop so dug is not exposed so long to disease infection as is one allowed to ripen completely, but mature seed is only less productive when diseases are prevalent. This applies even more strongly in the case of degenerate troubles such as Mosaic, Leaf Roll, etc. Certified seed is more or less an answer, these tubers being selected from fully ripened and matured crops.

PERTINENT TOPICS.

GEO. L. SUTTON,
Director of Agriculture.

PORKERS AND BACONERS.

Pig raising is obviously allied to dairy farming, because of the skim milk produced as a by-product during the operations of the latter and its profitable utilisation by the pig. Despite this, the raising of pigs has not progressed in this State as rapidly as could be expected, having regard to the increase in the number of our dairy cattle. As the fundamental method of bringing about an improvement in this direction it was considered essential that a definite plan to produce the most suitable carcase for pork and for bacon should be decided upon and recommended to farmers.

So that the plan could be accepted not only by Departmental Officers, but by others interested in this matter, it was decided to have a conference with representatives of the Royal Agricultural Society, as representing the agriculturists, and also with those interested in the bacon industry. The result of the Conference has been fully reported by the Superintendent of Dairying (Mr. G. K. Baron-Hay) in the last issue of this Journal.

Summed up, it was unanimously agreed, and quite recently (21-5-30) approved by the Royal Agricultural Society, that the requirements for both the pork and bacon trade could best be met by the Berkshire-Tamworth comeback, and that no single pure breed quite met requirements as well as this double cross. The breeding of this ideal baconer involves two stages instead of one, as would be the case if one pure breed had been suitable for the purpose. This slight difficulty can be readily overcome if each stage is made the work of separate farmers, viz., some who make it their business to raise the first cross of Berkshire-Tamworth or Tamworth-Berkshire in order to produce the dams of the second cross, and other farmers whose business it will be to purchase and mate these first cross-bred dams with a pure Berkshire boar to produce the second cross porkers and baconers.

Already some farmers are producing the Berkshire-Tamworth cross sows, and, as part of the Departmental policy in connection with stimulating pig raising, and to give effect to the decisions agree[illegible] the Conference, it is recommended that this plan become more gen[illegible] and that a number of farmers make a speciality of raising Berkshire x Tamworth or Tamworth x Berkshire sows for sale to those intending to sell porkers or baconers, and who will mate these cross-bred sows with a pure bred Berkshire boar.

Those whose intention it is to carry out the first stage and breed Berkshire-Tamworth or Tamworth-Berkshire sows are requested to forward their names to this Department. This request is made so that those who propose to carry out the second and final stage of breeding porkers or baconers may be advised where they can purchase the dams they need.

A CONVENIENT METHOD OF DISTRIBUTING "OATS" TO SHEEP.

The illustration herewith shows an adapted harvester box attached to a Ford car, and was used by Mr. J. Deane Hammond, of "Cuttening," Kellerberrin, during the past season for feeding "oats" to his sheep in the summer. The adapted box is twelve inches wide, made with a wooden back to which are attached two ⅜in. iron stays to hold the sides taut; it holds 1½ bags—180 lbs. This weight is considered sufficient, as the box itself weighs a considerable amount, and is supported on the running board, to which it is attached by two cultivator bolts. The box is also attached to the side at each end by iron straps. The oats are allowed to trickle on hard ground as the car is moving, the rate of flow through the door is regulated by the lever-handle, which is close to the right hand

Attachment to Car for feeding oats to Sheep.

of the driver. The sheep pick up the grain without waste, and as they run after the car obtain that exercise which they fail to obtain when fed at stationary feeders. This method has the advantage in that it prevents "crowding," and thus affords an equal opportunity to all the sheep to secure their ration. With lambing ewes it has the special merit that it minimises the risk of loss from fatty infiltration of the liver on account of the exercise they are compelled to take when following the car track to secure the oats.

TRIAL WITH LUCERNE SEED FROM THE ARGENTINE.

In March, 1929, a small quantity of "Santa Fe" lucerne seed from the Argentine was supplied to the Department of Agriculture by Mr. C. L. K. Foot, of Subiaco, for trial in this State.

With the object of ascertaining its suitability in different parts of Western Australia the seed was distributed to several of the Experiment Farms in the Wheat Belt under the control of the Department, and to settlers in the South-West portion of the State.

Reports received in connection with the growth of this variety indicate that, compared with the "Hunter River" variety from New South Wales Hunter River Valley, it is not as suitable for our conditions as the latter, which was taller and made decidedly better growth.

These results indicate that the "Santa Fe" variety of lucerne is not to be preferred to the New South Wales variety, and no advantage will be gained by cultivating it in this State.

IS THE TOMATO A FRUIT OR A VEGETABLE?

Recently my opinion was asked upon the above question. I am including my views in these notes as I have since learnt that the matter is likely to be of considerable general interest.

Botanically, any part of a plant which contains the seeds is a fruit, irrespective of the use it may be put to. In a strict botanical sense, the tomato then, is a fruit.

If, however, the botanical definition be accepted as being the one for ordinary everyday use by the average person, then similarly pumpkins and French beans must be called fruits, for botanically this is what they are. To call them "fruits" would, however, be ridiculous, for to do so would be entirely opposed to the generally accepted common practice. One would look with amazement in a fruiterer's window at a lot of pumpkins—however tastefully displayed—if they were amongst, say, peaches and grapes, and marked fruit.

It seems, therefore, that the most reasonable way to approach this question "Is the Tomato a fruit or a vegetable?" is to have regard to the household or commercial meaning of these two terms. Having regard to this viewpoint, it is suggested that by vegetable is understood a plant, or part of a plant, which at a meal is usually served either cooked or as a salad, with the meat, and fruit is that part of a plant which is served as dessert.

From inquiries which have been made it would appear that the Tomato is not generally, if ever, used as dessert, either in Australia or in Britain. Under these circumstances the conclusion has been arrived at that in the household or commercial sense the Tomato is to be regarded as a vegetable.

PRESENT COMPARATIVE VALUE OF FEEDING STUFFS.

G. K. BARON-HAY,
Superintendent of Dairying.

During the last few months the writer has received numerous inquiries regarding the comparative value of various foodstuffs on the market. These have no doubt been prompted by the high prices ruling for bran and pollard since the beginning of the year, the latter being almost prohibitive.

There is no doubt that in normal seasons and under normal trade conditions the ruling prices for foodstuffs do approximate to their relative feeding values. Where for some reason, however, the market becomes disorganised, the current market price of a foodstuff may be out of all proportion to its feeding value.

The following notes therefore have been prepared to assist farmers in selecting those foods likely to give the most economical returns when fed to stock.

The values are based on the average prices ruling in Perth during May, 1930, for the respective foodstuffs.

TABLE I.

Showing Nutritive Ratio, Starch Equivalent, Price per unit Starch Equivalent, and Price per Pound Starch Equivalent.

—	Nutritive Ratio. 1:	Production Starch Equivalent.	Market Price.	Price per Unit S.E.	Price per lb. S.E.	Digest. Proteins.
		%	£ s. d.	s. d.	d.	%
Concentrates—						
Meat Meal	0·4	90	17 10 0 per ton	4 4¼	2·33	72·3
Skim Milk	1·5	8·8	0 0 1½ ,, gall.	3 9½	2·03	3·6
Butter Milk ...	1·5	8·2	0 0 1½ ,, ,,	3 10½	2·08	3·4
Cotton Seed Cake ...	1·8	74	15 10 0 ,, ton	4 8½	2·52	27·7
Linseed Meal ...	2·2	79	16 10 0 ,, ,,	4 8	2·50	26·0
Field Peas	3·0	73	0 9 0 ,, bush.	4 7¼	2·46	19·0
Grain and Grain Products—						
Wheat Bran ...	4·5	45	8 10 0 ,, ton	4 2¾	2·26	10·6
Wheat Pollard ...	4·2	53	9 10 0 ,, ,,	4 0	2·14	13·4
Oats	7·9	60	0 2 2 ,, bush.	2 3¼	1·21	8·0
Barley	7·8	73	0 3 4 ,, ,,	1 10½	0·91	9·0
Wheat	7·5	72	0 4 10 ,, ,,	2 6¾	1·37	10·2
Hay or Chaff—						
Oaten	10·2	35	4 7 6 ,, ton	2 6	1·34	5·6
Wheaten	9·0	35	4 17 6 ,, ,,	2 9	1·47	4·0
Subterranean Clover Hay, Prime	3·9	31	4 0 0 ,, ,,	2 8	1·43	11·8
Potatoes, Small ...	14·5	17	2 0 0 ,, ,,	2 4	1·25	1·1

In buying feeding stuffs it is extremely difficult to form an exact estimate of the relative money values of those feeds by a consideration of their price per ton. Before therefore passing to a study of the results of the figures shown in the table, it will be necessary to understand exactly what these figures convey, and how far they may be relied upon when purchasing foodstuffs.

All foodstuffs may be split up by chemical analysis into the following constituents:—

1. Moisture. 2. Dry Matter.

A. Ash or Mineral Matter. B. Organic Matter.

i. Crude Proteins. ii. Fats. iii. Carbohydrates. iv. Fibre.

In calculating the values of foodstuffs the organic portion contains the important constituents, and under the present system of valuation determines the comparative feeding value of any food.

Crude Proteins.—This class of substances represents the organic matter containing nitrogen, and may be considered as essentially the flesh-forming material of any foodstuff.

Fats.—The fats of foodstuffs are essentially the energy and heat producing constituents, but besides supplying heat or energy they assist in building up the body fat in animals. Fats do not contain any nitrogen and cannot therefore replace proteins in the ration of animals.

Carbohydrates consist principally of sugars and starches, which chemically contain the same substances as fats, but in different proportions, so that on burning they produce less than half the energy or heat than the fats do, and are therefore not so valuable as fats. These substances cannot replace proteins in the ration as they do not contain any nitrogen.

Fibre.—Fibre consists largely of the cell envelopes of plants and is the least digestible portion of the foodstuff. A high percentage of fibre in a food therefore can generally be taken as an indication that it is low in feeding value. Fibre, if digested, performs similar functions as do the carbohydrates and are often grouped with digestible carbohydrates.

Nutritive Ratio.—As neither fibre, carbohydrates nor fats can replace protein in a food, the relative proportion of nitrogen-bearing constituents or proteins to the non-nitrogen-bearing constituents should always be borne in mind. The proportion of flesh-formers to fuel and fat is called the "nutritive ratio," and is shown in Column I. The more nitrogen a food contains the lower will the figure for the nutritive ratio be, and the food is referred to as having a narrow ratio if the ratio approximates 1:4.0. For instance, in the case of wheat bran, each one pound of protein or flesh-former is combined with 4.5 pounds of carbohydrates and fat.

Production Starch Equivalent.—For the purpose of comparing the value of one food with another, chemists have sought to reduce everything digestible to one common factor so that foods may be compared directly with one another.

For the purposes of this article the comparison of foods has been based on their Production Starch Equivalents, that is by comparing figures representing that amount of pure starch which would produce the same amount of fat when eaten by an animal as 100 lbs. of the feeding stuffs being compared. This figure is the most accurate method of comparing feed stuffs, as it is based on the digestible nutrients only, and by experiments carried out with animals, makes an allowance for the work done in digesting the food. The starch equivalent is therefore low in the case of very fibrous foods.

Although this valuation does not denote all the properties of any food, a farmer may feel quite safe in allowing himself to be guided by these figures, provided attention is paid to the following factors, which affect their practical worth.

Wholesomeness.—It is a matter of experience that stock thrive better on certain foods in contrast to other foods supplying similar nutriment by analysis. In Table I. the value for a unit of starch equivalent in oats is 2/3¼ as compared with 2/6¾ in wheat. The difference in the nutritive ratio is very slight, and so that unless experience shows that oats are in some way detrimental to the animal to be fed, and wheat is more wholesome, then certainly oats should be bought in preference to wheat on the score of cheapness.

Palateableness.—Stock exhibit preference for certain foods, but this should not be allowed to become too costly. Palatability can often be improved by the addition of condiments, such as salt or molasses, or by mixing.

Change of Feeding Stuffs.—All feeders who have had occasion to change the foods fed to stock have noticed that at first stock do not "take to" the new ration, and in some cases, therefore, the new ration is not viewed favourably. This is often the case when starting to feed silage. Changes in foods should always be gradual, especially if the nutritive ratio in the foods to be substituted vary greatly.

Appearance.—No doubt appearance is often paid for by feeders. Recently some bran selling on the local market has had quite a dark colour and appeared coarser than the bran to which local feeders had been accustomed. When examined by the Department, however, this bran conformed to the standards required under the Feeding Stuffs Act equally as well as more attractive samples.

In perusing Table I. it will be seen that the three cheapest stock foods at present on the market for the production of work are:—

Price per lb. Starch Equivalent.

	pence.
Barley	0·91
Oats	1·21
Wheat	1·37

whereas bran and pollard are amongst the dearest foods at present prices, with values per lb of starch equivalent as follows:—

	pence.
Pollard	2·14
Bran	2·26

Barley, though eminently suitable for feeding to either cows or pigs, is not available in unlimited quantities. This, however, does not apply to wheat or oats.

Wheat is a suitable feed in large quantities for pigs or poultry, but is dangerous when fed to horses or cattle in large amounts. In the ration for dairy cows it should not exceed a quarter of the total grain fed. By commencing with a small quantity horses may gradually become accustomed to eating up to 9 lbs. daily without injury, but this quantity should be fed with considerable caution.

Crushed wheat may be used to replace pollard for feeding to pigs, and will effect a considerable saving in the feed bill, as is shown below:—

TABLE II.

——	Protein.	Starch Equivalent.	Cost.
	%		
Wheat ... ... 100 lbs.	10·2	72	8·05s.
Pollard ... ... 100 „	13·4	53	9·50s.
Saving on 100 lbs.	...	...	1·45s.
Saving on Short Ton	...	...	£1 9s. 0d.

Where skim milk is available on the farm, the saving effected by substituting crushed wheat for pollard is as shown in Table 2 above, namely, £1 9s. per short ton, no other concentrate being required where skim milk is available.

It will be noticed that the nutritive ratio of wheat, i.e., 1 : 7.5, is wider than that of pollard, i.e., 1 : 4.2. This should be borne in mind when feeding wheat in place of pollard, as disappointing results may be obtained unless this wide figure for wheat is not remedied by the addition of some highly concentrated food. For this purpose, meatmeal, cotton seed cake, linseed cake or peas are all suitable. At present prices, however, it will be found that these mixtures, while approximating in composition and feeding value to pollard, do not effect a great saving in the feed bill owing to the relatively high prices of these concentrates. When, however, the prices are satisfactory, meatmeal may be added to wheat in the proportion of 1 part to not less than 10 parts wheat, and the other foods mentioned should be mixed in the proportion of 1 part to 4 parts wheat.

Oats.—None of the objections raised above when dealing with wheat for feeding to stock, particularly cows or horses, apply to oats. No other cereal is as safe, as satisfactory, or as well calculated to maintain condition and health as is oats. For a daily ration for cattle, oats can well replace bran at present prices. When crushed oats are used to replace bran in feeding cattle, a considerable saving in the feed bill may be expected, as is shown in Table 4.

In Table I. it will be noticed that oats have a nutritive ratio of 1 : 7.9, whereas bran has a narrower ratio of 1 . 4.5. In other words, bran is a more concentrated supplier of protein or flesh-forming food than is oats. This is important where oats has to be fed to cows for the production of milk, as milk is a highly nitrogenous substance.

Where subterranean clover hay, however, is available a very cheap ration may be compounded, using 4lbs. subterranean clover hay to every 1lb. of oats fed in addition to any cereal hay or pasture that stock may be receiving. The saving amounts to as much as £4 10s. 9d. per ton where subterranean clover hay is valued at £4 per ton. (See Table III.)

TABLE III.

—		Protein.	Starch Equivalent.	Cost.
Subterranean Clover	400 lbs.	47·2	124	14·29s.
Oats	100 „	8·0	60	5·50s.
	500 „	55·2	184	19·79s.
Therefore, Mixture	100 „	11·04	46	3·96s.
Bran	100 „	10·6	45	8·50s.
Savings on 100lbs. of Mixture ...	...	...	...	4·54s.
Saving on Short Ton	...	...	...	£4 10s. 9d.

CENTENARY PRODUCTION CERTIFICATES FOR WHEAT.

I. THOMAS,
Superintendent of Wheat Farms.

The centenary production certificates for wheat were limited to those farmers who harvested at least 200 acres of wheat for grass during 1929, the Centenary Year. The yield, which was from the total area harvested, was determined by agents' dockets plus the amount reserved for farm requirements.

Three certificates were available, viz., an Award of Merit to those farmers whose crops, grown last year, averaged at least 15 bushels per acre; an Award of Distinction to those whose crops averaged 18 bushels, and to those farmers whose crops averaged over 21 bushels, an Award of Special Distinction. A medal is accompanying each certificate.

The following is the list of farmers to whom the certificates have been awarded:—

Awards of Special Distinction—Over 21 bushels per acre:—

Competitor.	Address.	Acreage.	Yield per Acre.
			bus. lbs.
McDonald, J.	"Springvale," Gnowangerup	279	36 41/60
Willard & Willard ...	Gnowangerup	249	30 20/60
Formby, R. & Co., Ltd. ...	Gnowangerup	227	29 18/60
Lahoar, W.	Gnowangerup	292	28 41/60
Eckermann, H. W. ...	Yandanooka	257	28 4/60
Saunders, W. S.	Yandanooka	241	27 57/60
Booroondara Grazing Co., Ltd.	Toompup	216	27 46/60
Richards, T.	South Caroling	380	27 21/60
Mouritz, E. A.	Gnowangerup...	200	26 31/60
Moir, C. C.	Borden	220	26 15/60
Moore, Tom	Indarra	300	26 11/60
Stone, J. D.	Borden	584	26 3/60
Bastian, A.	Three Springs	333	25 30/60
Murray, W. W.	"Glen Yurret," Borden ...	423	25 28/60
Carter, R. & Son	Three Springs	277	25 16/60
Troy, M. F.	Indarra	364	25 22/60
Chambers, E. T... ...	Pallinup	280	24 49/60
Quartermaine, R.	Yandanooka	229	24 31/60
Brown, J. A.	"Raith," Yandanooka ...	270	24 28/60
Rudduck, A.	"El Cala," Coorow ...	860	24 19/60
Nottage, R. B.	Tammin	249	24 13/60
Darby, A. H.	Lake Grace	200	24 1/60
Hammond, J. Deane ...	"Cuttening," Kellerberrin ...	300	23 32/60
Smith, H. R.	Yandanooka	545	23 25/60
Wilson, A. F.	"Fairview Farm," Dumbleyung	550	23 3/60
Johnston, A.	"Wendouree," Gnowangerup	520	22 50/60
Stone, S. G.	Borden	231	22 25/60
Clark, R. W.	"Rosebury," Carnamah ...	750	22 14/60
White, W. T.	"Rosedale," Winchester ...	360	22 8/60
Browning, H.	Yandanooka	222	21 54/60
Thomas, C. F. & Sons ...	Three Springs	526	21 53/60
Mott, C.	Moulyinning	249	21 17/60

Award of Distinction.—Over 18 and under 21 bushels per acre :—

Competitor.	Address.	Acreage.	Yield per Acre.
			bus. lbs.
Mott, H.	"Redhill," Moulyinning ...	222	20 48/60
Cardwell, C. H.	Noman's Lake	223	20 47/60
Green Bros.	"Bushy Park Farm," Carnamah	640	20 38/60
Smith, C. & Sons	Bruce Rock	2,765	20 36/60
Hocking, H. R.	"Quondong," Tammin ...	392	20 31/60
Coad, S.	"Killarney Farm," Nippering	260	20 30/60
Morrell Bros.	"The Ironbarks," Greenough	262	20 26/60
Cousins, A. H.	Arrino	700	20 17/60
Bishop, H. F.	"Oruba," Lake Grace ...	212	20 8/60
Braysher, F. E.	Kellerberrin	487	19 42/60
Prowse, E. W.	"Omagh," Doodlakine ...	453	19 3/60
Hornsby & Son	"Denewood," Moulyinning...	344	18 54/60
Jackson, H. E.	"Koo-lyn," Bruce Rock ...	285	18 49/60
Crawford, A. H.	"Milroy," Brookton ...	290	18 46/60
Mackin, C. C.	Tammin	558	18 44/60
Strutton, A. R.	"Narrayarra," Three Springs	546	18 43/60
Ellis, M. P. & E. G. ...	Bruce Rock	296	18 42/60
Lucas, F.	"Floradale," Carnamah ...	385	18 40/60
Garrett, G.	Bruce Rock	697	18 37/60
Merredin Experimental Farm	Merredin	335	18 32/60
Ward, H. F.	"Mt. Rest Farm," Dumbleyung	218	18 29/60
O'Grady, L.	Pantapin	390	18 23/60
Nichols, R.	Kulin	751	18 12/60
Murray, A.	"Quonyonbing," Tinkurrin...	415	18 9/60
Clark, A. & J.	Kellerberrin	688	18 2/60
Downie, J. C. & G. ...	"Milldowns," Trayning ...	550	18 0/60

Awards of Merit.—Over 15 and under 18 bushels per acre. :—

Uppill, G.	Tammin	902	17 55/60
Johnston, H. C.	Kulin	723	17 54/60
Trotter, A. W.	"Barbabilling Farm," Kulin	464	17 52/60
Woodburne, J.	Lake Grace	281	17 50/60
Carwardine, F. J.	"Grassdale," Moulyinning ...	335	17 49/60
Henderson, J. H.	Kulin	483	17 45/60
Dinnie Bros.	"Cambrae," Buntine ...	1,250	17 43/80
Vaux, J. & S. F.	"Wigboro," Ongerup ...	450	17 43/60
Inzard, A.	Ogilvie	927	17 40/60
Mann, J. W.	Yorkrakine, *via* Tammin ...	609	17 40/60
Folland, S. L.	"Enfield Park," Waddy Forest	590	17 37/60
Stacey, J. & Son	"Sunnyvale," Quairading ...	2,000	17 35/60
Jenkins, R. M.	Corrigin	586	17 34/60
Langsford, E. W.	"Mt. Pleasant," Quairading	750	17 31/60
Morrell Bros.	"Mt. Rennie," *via* Geraldton	365	17 26/60
Bowron, L.	"Rockwell," Corrigin ...	450	17 20/60
Locke, J. A.	"Romani," Pithara ...	540	17 19/60
Smith, C. & A. H. ...	"Sunnyside Farm," Bruce Rock	1,340	17 17/60
Harris, R. W.	Dalwallinu	1,040	17 16/60
Crossland, J. L.	Corrigin	990	17 13/60
Prowse Bros.	"Wallatin," Doodlakine ...	1,349	17 12/60
Tayler Bros.	Yuna	1,080	17 10/60
Michael, L. G.	Roundhill	302	17 8/60
Forrester, J. K.	"Dunester," Carnamah ...	1,500	17 1/60
Sutherland, L. & S. ...	"Wamballa," Pithara ...	550	17 1/60
Bushell, J. C.	"Trelawney," Watheroo ...	450	17 0/60
Cook, W. T.	Burracoppin	400	16 44/60
Cusbert, L. C.	Bruce Rock	559	16 38/60

Awards of Merit—Over 15 and under 18 bushels per acre—*continued*:—

Competitor.	Address.	Acreage.	Yield per Acre.
			bus. lbs.
Prowse, A. E. C.	"Kogarrara," Doodlakine ...	425	16 35/60
Nicholls, H.	"Trelawny," Kellerberrin ...	218	16 34/60
Atkinson, A. G.	Ogilvie	597	16 29/60
Cripps Bros.	Ogilvie	600	16 23/60
Dwyer, J.	"Ularing," Southern Brook	590	16 23/60
Barr, D. F.	"Glenlaurall," Shackleton ...	610	16 21/60
Horsman, H. & Son ...	Corrigin	561	16 20/60
Rendavey, H. R.	Jibberding	500	16 16/60
Gard, T.	"Wattle Grove," Kukerin ...	320	16 3/60
Gibbs, R. T.	Kellerberrin	352	16 2/60
Hughes Bros.	"Strathmore," Minnivale ...	360	16 1/60
Strange, P. A.	"Cotswold," Yarding ...	440	16 0/60
Park, C. H..	Korraling	900	15 56/60
Richardson, E.	"Jam Creek," Broomehill ...	340	15 49/60
Faulkner, W. J.	"Kukerin Soak," Kukerin ...	372	15 47/60
Gamble, R. A.	"Lyndhurst Farm," Kondinin	500	15 47/60
Bahr, E. O.	Kukerin	337	15 46/60
Dring, C. W.	"Lindum," Carnamah ...	955	15 45/60
Dring, G.	"Lindum," Carnamah ...	955	15 45/60
Allen, E. V. D.	"Lindum," Carnamah ...	955	15 45/60
Jackson, E. W.	Narembeen	380	15 40/60
Blatch, B. G.	Dulbelling, *via* York ...	260	15 40/60
Dunwell, P.	Yealering	230	15 39/60
Orr, R.	"Linwood," Newdegate ...	925	15 36/60
Fulwood, C.	Corrigin	352	15 34/60
Bolton, L. B.	"Burlington," Namban Siding	630	15 24/60
Muntz & Son, J. N. ...	Bruce Rock	379	15 24/60
Jewell, J. D.	Corrigin	602	15 15/60
Dumsday, L.	"Talgomine Downs," Goomarin	412	15 13/60
Charsley, A. J.	"Nampup," Nyabing ...	550	15 12/60
Lee & Sons	"Jandarra," Trayning ...	800	15 11/60
Baxter, C. J.	"Doolwa," Doodlakine ...	460	15 1/60

THE WILD TURNIP.

(*Brassica Tournefortii*, Gouan.)

A PRELIMINARY NOTE.

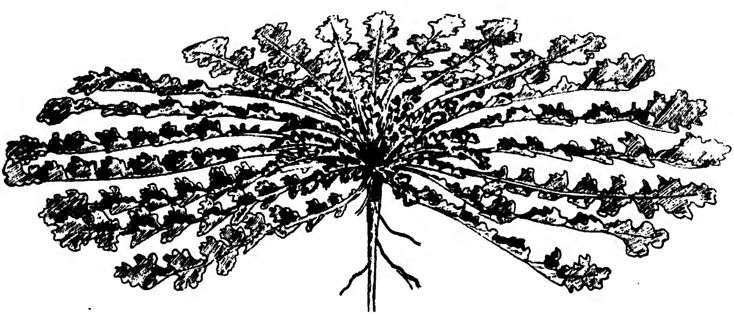
C. A. GARDNER,
Government Botanist.

The Wild Turnip is proving to be one of the most serious, if not actually the most serious, of all the weeds with which the wheat farmer in Western Australia has to contend. Like many other obnoxious plants it came here unnoticed, gradually gaining ground and increasing in aggressiveness, until to-day it has spread to an alarming extent, and is still spreading.

This weed appears to have been introduced into Western Australia from abroad about the year 1913, the centre from which it has spread being not far removed from Hine's Hill or Nangeenan. Due probably to its superficial resemblance to Wild Radish (*Raphanus raphanistrum*), the weed was not regarded very seriously, and it was not until 1927 that it came under the notice of the Department of Agriculture. Now it has gained a firm footing in the districts lying between Southern Cross, Doodlakine, Belka, and Kununoppin, and unless immediate steps are taken by farmers, will undoubtedly cause serious losses.

The fact that Wild Turnip is not known to occur in any other State of Australia would indicate that it reached our shores either as a seed impurity, or amongst straw packing, which has accounted for the introduction of so many undesirable plants. Had the weed been promptly recognised and reported, its control would have been a relatively simple matter: to-day it has become so widespread that its eradication must be an undertaking requiring much patience and several years to fulfil.

Although so common in many districts, there are farmers who confuse this weed with Wild Radish, Mustard, and, in the young state with Cape Weed. The notes on its habit of growth, therefore, may be found of some use. They are not as complete as could be desired, but the writer has not yet seen the living adult plant.



Wild Turnip appears after the first winter rains. The two first leaves (seed-leaves) are heart-shaped, and are succeeded by small hairy toothed leaves one to two inches in length. Figure B illustrates this. The normal

leaves (see Fig. A) are long and narrow and much divided, the divisions reaching to the midrib. The leaf is a rich green in colour and sprinkled with short white hairs, the underside being of a paler green. The terminal lobe of the leaf is the largest, and the lateral lobes decrease in size downwards, until the lowest lobes are represented by small wing-like teeth. The veins are fairly conspicuous, and the midrib broad and whitish. These adult leaves lie upon the surface of the soil in a mat-like rosette radiating in all directions, only the youngest inner leaves being at all erect. The subterranean parts consist of a thick whitish taproot and strong lateral roots. From the basal rosette of leaves arise one or more stems apparently bare of foliage and erect and stiff. These stems branch repeatedly upwards (as illustrated) until a broad summit of twiggy branches is formed. The flowers arise singly from these ultimate branches on slender stalks. They are almost identical with those of Mustard, and yellow in colour, but larger.

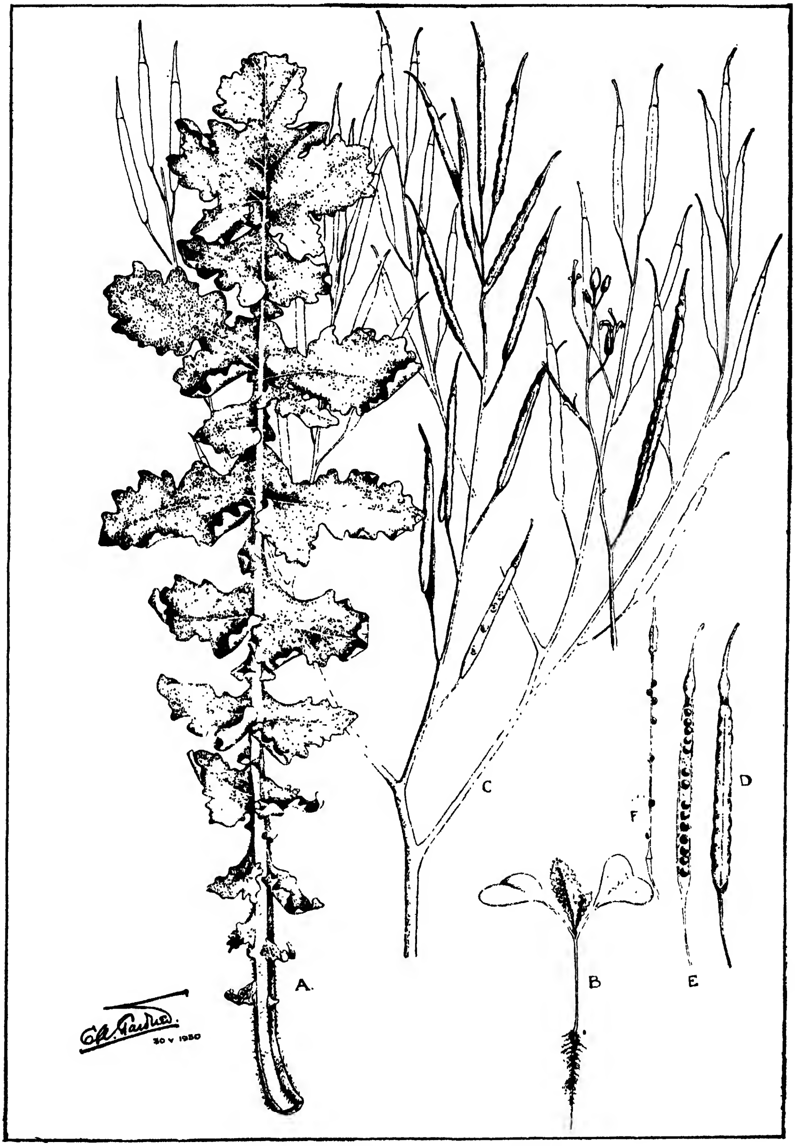
The flowers in turn are succeeded by long and narrow green pods which contain two longitudinal cavities separated by a transparent membrane. Each cavity opens outwards by two lids or valves which open from the base upwards. The upper quarter of the pod is separated from the rest of the pod by a slight constriction, and contains one or two seeds which are never shed since the valves do not extend to this height. This portion is known as the "beak," and is pointed. Figures D. E and F illustrate this "beak." The beak is of considerable importance in the spread of the weed.

As the seeds ripen, the branches of the plant turn inwards at the summit after the manner of a burned wattle, and the stem breaks away at the base. The outline of the leafless part of the plant is now somewhat spherical, and the plant being light in weight is easily rolled along the bare soil by the wind. The ripened pods open and shed their seeds as the plant rolls along. Summer whirlwinds will often lift the plants over fences and similar obstacles, but scrub country offers an effective barrier. After the plant finally comes to rest it will probably have opened all its pods and shed its seeds during transit. There remain the beak seeds, which are never liberated. These in time break off with the persistent part of the pod, and are ready to germinate with the next winter rains. It will be seen, therefore, that the Wild Turnip is wonderfully equipped for effective seed dispersal. In addition to its own devices the plant is distasteful to stock with the exception of pigs, so that when once grown to maturity one plant may be responsible for several hundreds in the following year. It is not known for how long the seeds remain in the soil in a viable condition, but it is probable that, like the Wild Radish, they retain their viability for several years.

DISTINCTIONS FROM ALLIED PLANTS.

In the young state it is said that the Wild Turnip is often confused with Cape Weed. The similarity rests entirely upon the rosette-like growth of young leaves and their mode of division. The Cape Weed, however, has a fibrous root system and not a tap-root, and the leaves are distinctly whitish underneath. In addition the leaf-lobes are not so much incised, and the plant has no turnip flavour—a flavour very pronounced in the case of the Wild Turnip.

The Wild Radish (*Raphanus raphanistrum*) is in some respects similar, but the stems are leafy, and the leaves not so much divided, and the basal leaves do not as a rule lie in a flat rosette like those of the Wild Turnip.



EXPLANATION OF PLATE.

A. Leaf (half natural size). B. Young plant, showing primary and secondary leaves. C. Illustrating part of an inflorescence, and the general habit of the summit of the plant when in seed. D. Siliqua viewed from the side showing the beak and dorsal nerve of one valve. E. Section showing a siliqua with one valve removed and the seeds in position. F. View showing the ripe siliqua with the valves removed, the central partition with some of the seeds in situ, and the persistent beak. (Icon. origin.)

The flowers of Wild Radish are either white, yellow or pale pink-purple, and have violet veins. The seed-pod does not open vertically with two valves, but the pod is constricted between the seeds, and ultimately breaks up into one-seeded portions at these constrictions. The seeds are larger than those of the Wild Turnip.

The so-called "Mustard" (*Sisymbrium officinale*) has very different and smaller leaves, and the pods are much longer and narrower, beakless, and contain many more seeds than those of the Wild Turnip. The seeds are also much smaller.

The Wild Turnip is most prevalent around Hine's Hill and Nangeenan. It occurs to the south at Belka where it is also common, and it is found also near Bruce Rock. Eastwards it spreads to near Southern Cross, and its western limits at present are not far removed from Kellerberrin. It is also found in the Salmon Gums district between Scaddan and Bete, and is apparently most common near Dowak. Most probably it has been introduced into the Mallee Areas through chaff purchased from the Eastern Districts.

CONTROL.

In controlling the Wild Turnip it is important to restrict the weed to the area already occupied by it as a preliminary measure. It should be remembered that the plant is an annual, and the prevention of seeding is one method of control.

Late seeding of the crop, after the weeds have appeared and been cultivated, is one method to be employed. If good and early winter rains could be relied upon, the difficulty of eradication would be comparatively simple, but in many seasons the rains do not commence until late, and this does not allow of effective killing by cultivation after growth of the weed. In such cases it would be necessary to remove by hand any weeds which appeared in the crop.

Fallowing is the most radical method of treating the weed, keeping the fallow quite clean by repeated cultivation. Where the weed is well established it may be necessary to resort to fallowing for two years in succession, especially if no early seasonal rain falls. This system would allow of one entire season for germination, and permit also of the soil being cultivated the second winter before planting. Care should be taken, however, to see that all adjacent land is kept free from seeding Wild Turnips, otherwise the fallowing work would be wasted since seeds from adjacent areas may be blown on to the fallowed land.

Wild Turnip occurring on roadsides must be regarded as a menace to adjoining farms, and it is important that roadsides should be kept clear of the weed. Grazing land affected by the weed presents a problem, since stock do not eat it. Hoeing and hand pulling must be resorted to in such cases, unless the weed can be kept mown down. A scythe should be found effective provided the plants are not too old, when they become very tough.

Badly affected crops in which the weed has been allowed to grow should have stubble fires run through them as soon as circumstances permit after harvesting.

Other means of keeping the weed out of paddocks are:—Avoid purchasing chaff from areas in which the weed is known to occur. Do not borrow agricultural machinery, especially harvesters which may harbour some of the weed seeds, from neighbours who have affected crops. Do not destroy windbreaks which may be in existence, and encourage the growth of scrub around paddocks. Grade all seed wheat.

Pigs may help in keeping small areas in check, since they appear to be rather fond of the young plants.

DESCRIPTION OF PLANT.

An annual attaining a height of three to five feet. Primary (cotyledonary) leaves broadly obcordate, long-petiolate, abrupt at the base, emarginate and conspicuously net-veined, the primary and secondary nerves anastomosing. Secondary leaves petiolate, lyrate-pinnatifid, sinuately lobed, the lowest lobes divided to the midrib, coarsely hairy as well as the petiole with short stiff, acute hairs.

Leaves chiefly or almost entirely radical, spreading in a broad rosette in the young plants, deeply pinnatifid, the lateral lobes broadly oblong, irregular, broad at the base, crenate, the terminal lobe the largest, the whole leaf as well as the petiole setose with stiff short hairs which are more numerous on the petiole than on the leaf-blade.

Stems erect and rigid, much branched upwards, the branches spreading when the plant is in flower, but becoming incurved at the fruiting stage. Racemes stiff, spreading-erect. Pedicels more or less erect, rather thick. Sepals brown-purple, oblong, obtuse, with often a terminal bristle, and occasionally a dorsal thick-based hair in the upper half of the sepal. Petals yellow, obovate-attenuate, long-clawed, narrowed into the claw. Anthers erect on slender filaments. Ovary linear, truncate.

Siliqua (pod) linear-tetragonal, the valves keeled with a prominent dorsal nerve and a few irregular secondary nerves; beak long-conical, about as broad as the pod at the base, tapering into a long acute point and usually two-seeded. Seeds purple-brown, spherical and minutely pitted

Original home: Spain, the Mediterranean region, the Orient, and Beluchistan.

POTATO FERTILISER TRIALS AT BUREKUP, 1929.

J. C. PALMER, Dip. Agric.

Potato fertiliser trials were again carried out at Burekup in the winter cropping. These trials were a continuation of a series of experiments which have been conducted in this locality for the last few years. The trials were planted on land which formed part of the property of Mr. C. L. Clarke.

The land selected for the trials might be regarded as more or less typical of the soil of the potato-growing areas of that locality. Portion of the experimental area was a heavy clay and some was a sandy loam. Each variation of manure was repeated six times and set out on the Latin Square system.

Certified seed obtained from Mr. F. Tonkin of the Young's Siding area was used. This seed was racked for some weeks so that it might be greened and hardened up, then dipped in the cold corrosive sublimate dip (4 oz. of sublimate to 30 gallons of water) for two hours. Forty-eight hours prior to planting the seed was cut into 2-oz. setts and the cut setts treated according to the "wet-bag" method.

Planting took place on 17th July. The setts were carefully placed at a height of about three inches from the bottom of the furrow and four inches from the surface. The first cultivation was given on 9th September, and this was followed by cultivation and hoeing all through the growing period, so that a good tilth was maintained in the growing crop.

During the earlier portion of the growing period the weather was cold and wet. Heavy rain fell periodically, but the weather towards the end was generally suitable. The crop was sprayed with a commercial preparation of Bordeux Mixture at the rate of 2 lbs. per 15 gallons, as a preventive measure against Irish Blight, on 22nd October. The crop was dug on 25th November.

The sulphate of ammonia was applied in two dressings, half of it at the time of planting, and the remainder as a side dressing on 31st August, when the plants were showing up well in the rows. With this exception all the manure was applied in the furrow at the time of planting.

NITROGEN SERIES.

Two variations of nitrogen, with the other constituents of the mixture remaining constant, were tested against the standard "Control" mixture. In all three mixtures 1,430 lbs. of super. and 210 lbs. of sulphate of potash formed the basis of the manure.

The actual results obtained in this experiment are given in the annexed table:—

Sulph. of Ammonia per acre in lbs.	Lbs. of Nitrogen per acre.	Yield in lbs. per plot 1/100 acres.	Yield in tons per acre.				Percentag Yield.
			T.	C.	Q.	L.	
250	50	162	7	4	2	16	100
500	100	161	7	3	3	0	100
...[*]	...	149	6	13	0	4	92

[*] Control.

The mixtures containing nitrogen gave a higher yield than that of the non-nitrogenous manure, though apparently there was little, if any, difference by increasing the quantity or sulphate of ammonia from 250 lbs. to 500 lbs. per acre.

SUPER. SERIES.

In this series two variations of superphosphate were used against the standard control mixture. The amount of sulphate of ammonia (500 lbs. per acre) and sulphate of potash (210 lbs. per acre) remained constant. The results of the trial are given below:—

Super. per acre in lbs.	Lbs. of Phosphoric acid per plot.	Yield in lbs. per plot.	Yield in tons per acre.				Percentage Yield.
			T.	C.	Q.	L.	
1,907	400	160	7	2	3	12	98
1,430*	300	163	7	5	2	6	100
1,668	350	176	7	15	1	12	106

* Control.

Though there was a certain amount of difference in yield, yet in no case was that difference sufficient to warrant an increase on the amount of super. in the control mixture.

POTASH SERIES.

In this series two variations of potash, with constant quantities of super. (1,430 lbs. per acre) and of sulphate of ammonia (500 lbs. per acre), were used against the standard control mixture. The details of the trial are given below:—

Sulph. of Potash per acre in lbs.	Lbs. of Potash per acre.	Yield in lbs. per plot 1/100.	Yield in tons per acre.				Percentage.
			T.	C.	Q.	L.	
415	200	153	6	16	2	12	105
210*	100	146	6	10	1	12	100
...	...	151	6	14	3	8	103

* Control.

The table indicates that there was apparently little, if any, increase in yield by adding sulphate of potash to the manure, although an analysis of potash-treated tubers shows an appreciable increase in starch content.

The Action of Liming the Land a Month prior to the Planting of Potatoes.

In addition to the general fertiliser trial at Burekup this year (1929), a liming trial was included. In order to afford a certain basis of comparison, two mixtures of manures containing different quantities of superphosphate and consistent quantities of sulphate of ammonia and sulphate of potash

were used against the standard control mixture. The variations of manure used per acre were:—

(1) 953 lbs. Super. (equivalent to 200 lbs. of Phosphoric Acid per acre).

(2) 1,430 lbs. Super. (equivalent to 300 lbs. of Phosphoric Acid per acre).

(3) 473 lbs. Super. (equivalent to 100 lbs. of Phosphoric Acid per acre).

To all three variations of manure there was added 500 lbs. of sulphate of ammonia and 210 lbs. sulphate of potash.

The land chosen for this trial was of a type similar to that of the potato-growing areas in the Burekup district, and adjacent to the fertiliser trial. The soil varied from a heavy clay loam and red loam to a sand. For a better comparison each manurial treatment—limed or unlimed—was repeated six times, and the individual plots were arranged in strips throughout the experimental area.

Slacked lime at the rate of 2 tons per acre was applied to the land one month prior to the planting of the potato crop. The lime was left on the surface and was well mellowed by rain before it was finally ploughed in during the planting operations.

It was observed during the ploughing, the subsequent cultivation, and finally in the digging, that the ground of the limed plots was much more friable than that in the unlimed portions. No difference in germination in the two areas was noticed, and the table below indicated the results obtained:—

Manure per acre in lbs.	Limed Plots.		Unlimed Plots.	
	Yield per plot in lbs.	Yield per acre.	Yield per plot in lbs.	Yield per acre.
		T. C. Q.		T. C. Q.
953lbs. super. ... ... 500lbs. sul. amm. ... ... 210lbs. sul. pot.	160	7 2 3	166	7 8 0
1,430lbs. super. ... ... 500lbs. sul. amm. ... ... 210lbs. sul. pot.	170	7 11 3	171	7 12 2
473lbs. super. ... ... 500lbs. sul. amm. ... ... 210lbs. sul. pot.	151	6 14 3	146	6 10 1

An average of all the limed plots against an average of all those which were not treated is shown below:—

Treatment.	Yield per plot in lbs.	Yield per acre.	Percentage.
Limed	160	7 2 3	100
Unlimed	160	7 2 3	100

Thus a consideration of the average result obtained from the experiment would indicate that liming at the rate of 2 tons per acre, one month prior to planting, has no effect on the yield of potatoes obtained.

The Action of the Fertilisers on Freshly Cut Potato Setts.

In most districts the practice of cutting large potatoes into setts for planting is followed. In such areas some of the growers treat their seed by the "wet-bag" method, while others plants the setts straight off the knife. When cut setts are planted in the furrow, either they are placed in position just before the manure is sown, or just after. In any case, the manure may come into contact with many of the freshly cut surfaces of the setts, unless care is taken to press the cut surface into the "mould" at the side of the furrow. In order to test whether the application of manure to the cut surface of the sett has any injurious effect an experiment was also carried out.

Some seed was taken and cut, and then the setts were thoroughly dusted with manure and then planted. At the time of planting it was noticed that these setts were very squashy and wet. Six plots in different parts of the experimental area were planted. These all received the same attention as those in the rest of the trial area. There was a very poor germination (approximately 3 per cent. only) of the setts on these plots, and from a search made it was found that the setts had rotted away completely. This treatment is actually an exaggeration only of what occurs in numerous South-Western potato districts under ordinary fertiliser application.

Six other plots were planted with the cut surface uppermost. After the row had been planted the manure was sown in the usual manner. A certain amount of manure in consequence fell on the cut surfaces of the setts. During the growing period these plots were less vigorous than those of the control rows, and a loss of 10 per cent. in germination occurred.

Lastly, six rows were planted, and in them the cut surface of the sett was pressed into the mould before the sowing of the manure. This method is the normal method of planting used in the departmental trials. An average from these plots was also taken.

The table given below summarises the results obtained from these three methods of planting freshly cut potatoes:—

Method of Planting.	Average yield per plot 1/100 acre in lbs.	Estimated yield per acre.			Percentage Yield.
		T.	C.	Q.	
Setts well dusted with manure immediately prior to planting	...	...			...
Cut surface of sett pressed into the mould and fertilizer applied as is usual	151	6	14	3	100
Setts placed cut surface uppermost and fertilizer applied as is usual	137	6	2	1	90

Another method of obviating injury from direct contact of the fertiliser would be to plant the setts after the manure has been sown, and then to place cut surface *uppermost.* However, from the table it will be seen that the best method of planting cut potato setts is to place and press the cut surface into the mould of the furrow prior to the sowing of the manure.

A Summary of the Results obtained by the Trials at Burekup for the last Three Years.

These trials have now been repeated over a period of three years and the results, tabulated below, are calculated on the average result obtained from the yields of these three years:—

SUPER. SERIES—(1927-28-29.)

Manure used.	Average Yield in tons per acre. T.	C.	Q.	L.
1,905lbs. super. ... ... 500lbs. sulph. ammon. ... ... 210lbs. sulph. pot.	8	2	2	0
1,430lbs. super. ... ... 500lbs. sulph. ammon.* ... ... 210lbs. sulph. pot.	8	0	2	24
1,668lbs. super. ... ... 500lbs. sulph. ammon. ... ... 210lbs. sulph. pot.	7	18	0	4

* Control Mixture.

The table indicates that there is no advantage in increasing the weight of superphosphate beyond 1,430 lbs. per acre:—

POTASH SERIES—(1927-28-29.)

Manure used.	Average yield in tons per acre. T.	C.	Q.	L.
415lbs. sulph. pot. ... ... 500lbs. sulph. ammon. ... ... 1,430lbs. super.	7	19	3	8
210lbs. sulph. pot. ... ... 500lbs. sulph. ammon.* ... ... 1,430lbs. super.	7	15	1	12
0lbs. sulph. pot. ... ... 500lbs. sulph. ammon. ... ... 1,430lbs. super.	7	11	3	4

* Control Mixture.

This table shows that by increasing the weight of potash used per acre a small increased yield is obtained. This increase, though progressive, is so small that it is doubtful whether the increased cost of the sulphate of potash is justifiable *in these soils* from a point of yield only.

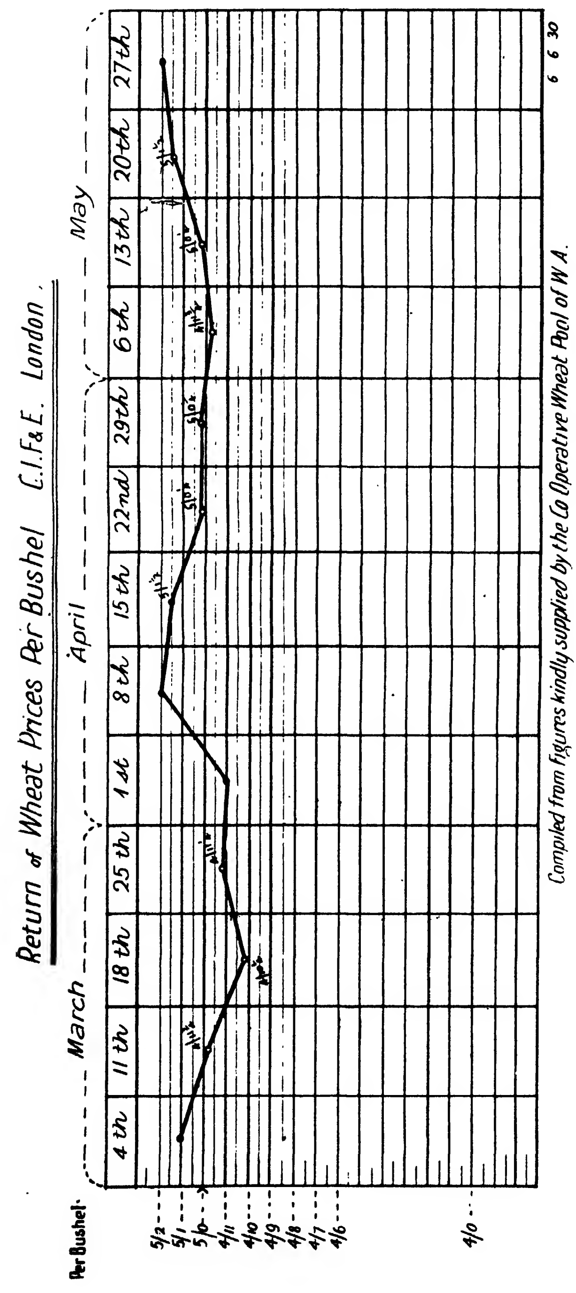
NITROGEN SERIES—(1926-27-28.)

Manure used.	Average yield in tons per acre. T.	C.	Q.	L.
350lbs. sulph. ammon. ... ... 1,430lbs. super. ... ... 210lbs. sulph. pot.	6	19	1	4
500lbs. sulph. ammon. ... ... 1,430lbs. super.* ... ... 210lbs. sulph. pot.	7	8	0	24
200lbs. sulph. ammon. ... ... 1,430lbs. super. ... ... 210lbs. sulph. pot.	7	5	2	6

* Control Mixture.

The variation in yield produced by the variations of the nitrogen was very small, and this would suggest there is little if any advantage in raising the quantity of sulphate of ammonia from 200 lbs. to 500 lbs. per acre. When the figures in the above table are considered from the percentage yield point of view,* it will be seen that in no case was there a 10 per cent. difference in yield. In order to allow for experimental error, no difference under 10 per cent. is regarded as an indication that this or that manurial mixture is more suitable.

* The actual percentage yields in this experiment were for 350 lbs. of Sulphate of Ammonia—96%, control mixture—100%.


Return of Wheat Prices Per Bushel C.I.F.& E. London.
March
April
May
4 th
11 th
18 th
25 th
1 st
8 th
15 th
22nd
29th
6 th
13 th
20th
27th
Per Bushel
5/2
5/1
5/0
4/11
4/10
4/9
4/8
4/7
4/6
4/0
Compiled from figures kindly supplied by the Co Operative Wheat Pool of W.A.
6 6 30

LIVE STOCK AND MEAT.

For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder, Smith & Co., Limited, Perth:—

COMPARATIVE YARDINGS OF STOCK AT METROPOLITAN FAT STOCK MARKETS, FOR MONTHS OF MARCH, APRIL, MAP, 1930.

	March.				April.					May.			
	5th.	12th.	19th.	26th.	2nd.	9th.	16th.	23rd.	30th.	7th.	14th.	21st.	28th.
Sheep ...	13,112	15,247	18,194	16,689	11,392	10,423	12,559	13,651	13,338	11,408	9,168	10,559	11,015
Cattle ...	829	732	853	757	555	603	642	717	725	697	651	483	885
Pigs ...	754	566	871	887	812	665	901	588	1,357	942	740	900	1,078

COMPARATIVE VALUES PER POUND.

—	March.				April.					May.			
	5th.	12th.	19th.	26th.	2nd.	9th.	16th.	23rd.	30th.	7th.	14th.	21st.	28th.
	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.
Mutton	6½	6	5½	5	5½	6	6	6	6	6	6½	5¾	5½
Beef ...	7	6½	6	6	7¼	8¼	8¼	8¼	9	8	8¼	8¼	7½
Pork ...	9¾	10½	10½	10½	10¼	10¾	10¾	10¾	10½	10¼	10¼	9	8
Bacon ...	9	9	9	9	9	9	9	9¼	9¼	9¼	9¼	8¾	8½

MARKET REPORT.

Messrs. H. J. Wigmore & Co., Ltd., of Wellington Street, Perth, have supplied us with the following information regarding Chaff available at the Metropolitan Chaff and Grain Auction Sales, held in Perth, for the period March to May, inclusive. In all cases the price quoted is for f.a.q. to prime Wheaten Chaff, packed in new bags:—

	Quantity.	Maximum.	Minimum.
March	1,100 tons	£5 5 0	£5 0 0
April	900 tons	£5 10 0	£5 0 0
May	1,100 tons	£5 5 0	£5 0 0

The period under review has been very disappointing from a grower's standpoint, qualities under f.a.q. to prime being difficult to quit at reasonable prices. At the time of going to press the market for f.a.q. to prime quality is firm, but f.a.q. and mediums are in very poor request at low prices.

Oaten Chaff.—During the past three months heavy supplies were available, and low prices had to be accepted. At one period prime quality sold at as low as £4 7s. 6d., and f.a.q. at £3 17s. 6d. However, during the past few days very little has been available, and the market now stands as follows:—

Prime green—£4 12s. 6d. to £4 15s. per ton.

F.a.q.—£4 5s. to £4 7s. 6d. per ton.

Mediums—£3 17s. 6d. to £4 per ton.

Oats.—The market has been over-supplied, and with a lesser demand auctioneers have been forced to quit consignments at very low rates, the undermentioned being closing quotations:—

Good heavy feed Algerian or Guyras—2s. to 2s. 2d. per bushel.

Medium feeds—1s. 8d. to 1s. 9d. per bushel,

Inferior, lower.

At time of going to press heavy rain is falling, and if our agricultural districts share in this splendid downfall, feed will be very plentiful, and this being the case the prospects of higher prices are very remote.

Wheat.—The market has fluctuated a little in sympathy with overseas prices, fa.q. selling at auction at from 4s. 6d. to 4s. 8d. per bushel; other qualities at lower prices according to sample.

METEOROLOGICAL INFORMATION.

Stations.	Temperature.				Rainfall.		Temperature.				Rainfall.		Temperature.				Rainfall.	
	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	MARCH, 1930.						APRIL, 1930.						MAY, 1930.					
					inches.	inches.					inches.	inches.					inches	inches.
Chapman State Farm	90·5	102·9	64·4	51·0	0·34	0·66	80·8	94·4	57·4	48·1	0·57	0·44	76·9	86·4	51·3	44·5	1·17	2·39
Geraldton	85·8	102·0	67·8	56·4	0·07	0·46	79·5	94·0	61·5	52·0	0·98	0·82	74·7	81·0	56·9	48·0	2·63	2·82
Walebing	88·5	102·1	63·3	53·0	0·65	0·76	78·3	91·0	55·0	45·0	1·36	0·71	73·3	83·0	49·9	41·0	1·85	2·57
Perth	85·4	99·0	66·0	55·0	0·32	0·78	77·2	89·3	57·9	47·8	2·29	1·58	70·8	79·0	54·6	46·5	2·47	4·91
Kalamunda	85·3	97·5	62·8	50·0	0·50	0·86	75·0	88·5	56·4	46·0	2·05	1·88	68·2	79·2	53·1	43·0	2·47	6·21
Bunbury	81·3	96·0	61·4	44·0	0·15	1·01	74·8	87·6	55·0	42·0	0·96	1·73	68·9	75·0	51·4	38·0	2·27	5·31
Bridgetown	86·3	98·8	54·1	39·2	0·78	1·05	78·0	92·8	46·5	38·0	1·06	1·72	68·7	82·0	46·5	32·0	4·15	4·64
Albany	72·8	84·6	60·9	52·0	1·51	1·55	71·2	89·8	55·1	47·0	3·74	2·75	67·8	80·3	54·3	47·0	5·79	5·02
Merredin State Farm	85·9	97·6	64·5	51·9	2·81	1·00	74·3	86·9	55·6	41·8	1·86	0·72	71·3	80·9	49·8	37·8	0·40	1·35
Northam	89·5	100·0	64·5	52·1	0·85	0·73	78·2	91·2	55·4	43·0	1·70	0·79	75·5	84·0	50·7	42·0	0·83	2·23
York	88·6	99·0	62·9	52·0	0·35	0·65	78·0	91·0	53·2	41·0	0·82	0·81	72·5	82·2	49·5	39·2	0·55	2·32
Narrogin State Farm	84·6	98·0	56·5	43·5	1·77	0·77	74·7	86·7	49·7	38·8	0·86	1·15	68·7	79·0	49·0	39·0	1·19	2·84
Katanning	83·5	97·2	58·8	46·0	0·84	0·96	74·2	88·7	50·5	39·7	1·26	1·17	67·6	79·0	49·7	42·3	2·45	2·35
Cape Leeuwin ...	73·3	87·0	63·3	57·2	1·32	1·25	70·4	84·5	60·2	54·0	2·53	2·18	67·7	76·0	57·9	48·5	5·34	5·79

PRODUCERS' MARKETS CO-OPERATIVE, LTD.

Report as follows for three months ending 31st May, 1930:—

Fruit.—For the three months ending 31st May fruit was well supplied. In the early part apples were realising high prices for all varieties and supplies holding throughout. Prices have eased, only prime lines meeting a good demand. D. Seedlings is the only variety short supplied, for which there is a big demand. Lemons realised good prices early, easing with extra supplies forward and firming again towards the end. Tomatoes well supplied early, and sold to a good demand for prime. Small and inferior were hard to quit. They have eased in volume, with prime realising good prices. Pears being short supplied and sold to a good demand throughout for prime. A good quantity of small sized were forward, but these were hard to quit, and realised very poor prices. Fair supplies still remain, the majority being from cool store. Prime are selling to a good demand. Passion fruit realised good values throughout. In March navels were well supplied, selling to a good demand, realising up to 21s. for dumps. They have since continued to increase in volume, and towards the end ¾ bushel of prime realised from 5s. to 10s. 6d., with dumps up to 15s. 6d. Grapes early were heavily supplied and sold to a poor demand, with supplies easing towards the end to improved values.

Vegetables.—Supplies of vegetables during the quarter have been consistently heavy. Values for metropolitan potatoes were low right to the finish of the crop, and growers almost without exception report a severe financial loss. The crop was one of the heaviest experienced in the district, mainly on account of growers using certified seed. It is to be regretted that values were so consistently low throughout the season, as this will curtail their operations next season. Country growers also felt the effect of the depression in the potato market and held consignments back, hoping for the market to rise. The held consignments were badly affected with "fly" when finally marketed and were hard to quit at any price at all. Values during the last month have firmed considerably, and at the present moment are high for good quality lines. A few washed lines are also being offered from the metropolitan area, and these are selling well. Swedes have been short in supply and the demand good, high values selling for well-graded washed lines. Pumpkin has been heavily supplied and the demand weak. We have had considerable difficulty in clearing out at satisfactory rates, inferior grades being quite unsaleable. Cabbage supplies have been heavy, and values for prime lines firm. Country lines were more plentiful this year than previous years. The majority of growers have yet a lot to learn in grading and packing this line for metropolitan markets. It is always advisable when consigning to pay strict attention to the grading, rejecting all second grade and packing tightly. Cauliflowers during the last month have been heavily supplied to a keen demand. Most lines are below the usual standard of quality this season owing to the scarcity of rain during March and April. Values are firm for prime lines, but the inferior grades are low. Peas have been heavier in supply than is usual at this time of the year. Values have been firm and the demand good. Supplies of beans both Runner and French have been heavy to a good demand throughout. White Onions gradually eased off during the period, and are almost finished; now a few lines coming forward from Manjimup district. Local Brown Onions are finished, but the imported lines are plentiful. Sweet Potatoes were

plentiful during the period and values steady. Rhubarb heavily supplied to a steady demand; values have been low. Celery also has been well supplied, and some prime samples offered. Values firm for all prime lines, and at times the inferior qualities sold well. Bunch lines were heavily supplied to a weak demand. Most lines are at glut level. Lettuce have been well supplied to a good demand for prime lines.

Eggs.—On 7th March eggs showed a slight decrease to a keen demand and improved values. Metropolitan hen, 2s. 0½d. to 2s. 2½d. On 12th March demand easier and prices were 1s. 10½d. to 2s. 1d. A further reduction on 21st March brought values to 1s. 7d. to 1s. 11d. On 4th April smaller supplies to a better demand, and hen sold at 2s. 1d. to 2s. 4½d. On 11th April stll higher values—2s. 6d. to 2s. 7½d. At the end of April the market eased, values being 2s. 4d. to 3s. 6d. To the middle of May the prices remained unchanged, and eased further on 21st May—1s. 10d. to 2s. 1½d.—and remained unaltered to end of May. Closing prices were: Metropolitan new laid hen, 1s. 10d. to 2s. 1½d.; pullet, 1s. 7½d. to 1s. 9½d; country, 1s. 7d. to 1s. 9d.

Poultry.—On 7th March demand improved for quality birds. Cockerels, 8s. to 11s. 6d.; Muscovy Drakes, 6s. to 7s. 6d.; Ducks 5s. 9d. to 6s. 9d. Turkey Gobblers—none offering. On 21st March lighter supplies to poor demand and values unaltered. Throughout April there was no alteration worth recording, except Turkey Gobblers were supplied at 20s. to 27s. 6d. pair for good birds, and medium from 14s. to 17s. Early May, most prices unchanged except Turkey Gobblers, which showed an improvement—28s. to 32s. 6d. On 16th May most lines still unchanged, although Turkey Gobblers easy—17s. to 25s. Prices for prime quality at end of May were: Cockerels, 8s. to 11s. 6d.; Muscovy Drakes, 9s. to 12s.; Ducks, 5s. 6d. to 6s. 6d.; Indian Runners, 3s.; Pekins, 5s. 6d. to 7s.; Geese, 10s. 6d. to 14s.; Table Hens, 6s. 6d. to 7s. 6d.; Turkey Gobblers, good, 26s. 6d. to 31s.; medium, 16s. to 20s.; Turkey Hens, good, 13s. 6d. to 14s. 6d., medium 10s. 6d to 11s.

Carcase Meat.—Early March: all lines well supplied to good values; Veal, 8¼d. to 9½d.; Lamb, 6½d. to 7d.; Mutton, 4¼d. to 4¾d.; Mutton, plain, 2¾d to 3½d.; Pork, 9d. to 10½d.; Beef, hinds, 6½d. to 7½d.; fores, 3½d. to 4¼d.

April increased supplies to improved values and about on a par throughout to the end of May.

Closing prices for prime were: Pork, prime, 9d. to 10d.; Veal, 7d. to 8d.; Lamb, 5d. to 7d.; Mutton, 3½d. to 4¾d.

WESTERN AUSTRALIA—DEPARTMENT OF AGRICULTURE.

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No. 20.—*The Pruning of Fruit Trees.* J. F. Moody. Price 2s. 6d.
No. 24.—*Hints to Stock Breeders* (revised). R. E. Weir.
No. 30.—*Descriptive Account of the Codlin Moth.* L. J. Newman.
No. 37.—*Conference of Producers,* 1910 *and* 1912.
No. 46.—*Fruit Packing and Marketing and Exporting of Fruit.* J. F. Moody and J. Ramage. Price 1s. 6d.
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No. 292.—*Cultivation of Onions.* E. T. Morgan, Vegetable Inspector.

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This publication contains valuable information dealing with all commercial fruits grown in Western Australia, including advice on planting, pruning, packing, manuring, fruit-drying, wine-making, insect and fungoid pests and their treatment, etc., and the whole forms a text book which every fruitgrower, whether large or small, should have in his possession. The price originally was 8s. 6d., but to allow of distribution being as wide as possible it has been reduced to 2s.

The Pruning of Fruit Trees, by J. F. Moody, Fruit Industries Commissioner:

This publication contains numerous illustrations, being reproduction of photographs taken in this State, of pruned and unpruned trees, which make the details set out in the letterpress particularly easy to understand. Price 2s. 6d.

Fruit Packing and the Marketing and Exporting of Fruit, by J. F. Moody, Fruit Industries Commissioner, and J. Ramage, Packing Instructor:

This publication contains invaluable information on packing and grading fruit for local and export markets. It is freely illustrated, and no fruit-packing shed should be without a copy. Price 1s. 6d.

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STERILITY IN DAIRY COWS.

Address to the South-West Conference, June, 1930, by E. F. TWADDLE, M.R.C.V.S.

Sterility in dairy cows may be defined as the inability of a sexually mature animal to conceive after being served repeatedly when on heat by a bull which is know to be fertile.

Here it is intended to discuss briefly the causes which, acting on the genital organs of the cow, produce sterility, either of a temporary or permanent nature. These are:—

CHRONIC INFLAMMATION OF THE WOMB.

Chronic inflammation of the womb in dairy stock which have been bred from and subsequently become sterile is very frequent. The disease is often insidious in its onset, and no symptoms of derangement may be noticed in the affected animal until the cows fail to conceive after returning repeatedly to the bull.

Cause.—Inflammation of the womb in cows is caused by infection of the womb with micro-organisms. The most opportune time for infection to take place is at or immediately after calving time, as the womb is then open to external influences, and the introduction of infective material from outside the animal's body is an easy matter.

Symptoms.—As the inflammation present is very often of a mild catarrhal nature, no definite symptoms of the trouble will be detected unless a careful examination is made of the affected womb. The cows appears in normal health and condition, but fails to get in calf. On the other hand when the infection of the womb is more virulent there will be present a muco-purulent discharge, which is particularly noticeable during heat periods when the mouth of the womb dilates slightly. In some cases it is constantly present even in between heat periods a discharge of pus from the inflamed womb. This discharge is often so great as to soil the tail and buttocks of affected cows. When the discharge is great a general appearance of unthriftiness in addition to sterility ensues.

Course of the disease.—The disease of the womb following inflammation will at times disappear spontaneously and the animal returns to normal condition to conceive at a subsequent heat, but in a great number of cases the inflammation spreads from the body of the womb in involve in turn the fallopian tubes and ovaries. In consequence the fallopian tubes become blocked and the ovum generated in the ovary is prevented from reaching the site of fertilization. When the infection reaches the ovaries these undergo degeneration and numerous cysts form in the substance on the surface of the ovaries. When the fallopian tubes and ovaries become involved the prospects of getting the cow in calf are not bright and the treatment necessary in those cases becomes prolonged and technical.

Prevention of inflammation of the womb.—It is in the matter of prevention of this condition that the stock owner has an important role to play because in preventing the onset of the affection he is also preventing the appearance of a state of sterility amongst his dairy stock. Inflammation of the womb in a great number of instances may be traced to neglect of ordinary hygienic principles in regard to treatment of in-calf dairy stock. The following points should be observed by all whose attention is directed towards the management of the dairy herd:—

(1) Cows housed or paddocked immediately prior to calving should be placed in the most hygienic surroundings possible. If housed the shed should be properly cleaned before the cow about to calve is allowed in. It is advisable to spray the walls, floor and fittings with a disinfectant solution—1 part lysol to 160 parts of water will make a reliable disinfectant solution for this purpose. A clean bed should be provided for the cow, hay or straw will serve this purpose provided that it is clean. If the bedding used is dusty it is advisable to allay the dust by sprinkling lightly with the disinfectant solution as used on the shed structure. Cows should not be allowed to calve down in paddocks which are covered with the droppings of other cows, as infection from manure may be carried by flies and deposited on the genital organs of the newly calved cow. During the summer months when the manure becomes dried and pulverized the wind will act as an agent to spread the contamination from the dirty ground surfaces of the paddocks on to the tail and back passages of cows allowed to lie in such surroundings. These precautions are especially necessary during the first three days after calving as then the womb is partially open and infection is likely to gain entrance and set up inflammation.

(2) In the event of it being necessary to render assistance to cows at calving time the person undertaking the task should use every care as regards his hands, arms, and any instruments or appliances required. Finger nails should be clipped short and cleaned, hands and arms washed thoroughly in a disinfectant solution—lysol 1 to 160 in water, *i.e.*, lysol one teaspoonful to every pint of water required. Any instruments or ropes required should be sterilized by boiling for 15 minutes prior to use and kept till required for use immersed in a disinfectant solution. The tail and back parts of the cow should be washed down with soap and water and sprayed with a disinfectant solution before proceeding to introduce the hand into the genital passage. Care should also be observed that manure passed by the animal in straining during the operation is not introduced with the arm—this may be obviated by an assistant ready to wash and disinfect the arm of the operator should contamination occur.

(3) *Retention of the afterbirth.*—This is frequent among animals that calve prematurely and is also met with frequently in cows which calve after the normal

period of gestation. The membranes do not separate completely from the inside surface of the womb, and the muscular walls of the womb fail to contract and produce separation and expulsion as should occur normally. When the afterbirth in the cow is not expelled within the first 24 hours after calving measures should be taken to affect and assist its removal. It is not a good policy to tear out the retained membranes forcibly, as in this process the womb is likely to be wounded and infection of the wounds is very probable. If the retained afterbirth is not removed with moderate traction a better policy is to fill up the womb with disinfectant solution by means of a proper syringe. A suitable disinfectant for this purpose is corrosive sublimate, 1 in 5,000 parts of water. The solution should be used at blood heat, an amount of one gallon being used for each douche. Should the animal strain and expel the fluid introduced whilst the operation is proceeding this is to be allowed and when the expulsion of the fluid has ceased for the time being the douching may be proceeded with. In this way infection of the womb from decomposing afterbirth will to a great extent be prevented and at the same time the effect of the fluid in the womb induces it to contract and expel the retained afterbirth. Douching should be carried out three times daily till the membranes come away and afterwards twice daily till all discharge has ceased. Care must be exercised with the syringe used, it is advisable to boil it for ten minutes before using each time. Isolation of a cow with retained membranes is advisable, as the discharges from the womb are certain to be septic to a great extent and it is possible to have infection spread from this source to other animals in the herd which are susceptible.

(4) Care and perseverance should be adopted in the treatment of all cases of a suppurative character which may occur amongst cows in a herd. Wounds which become septic should be treated antiseptically until healing takes place. If the discharge from septic wounds is great in addition to treatment the animal affected should be isolated. This precaution is also necessary in cases of inflammation of the udder where there is an abscess formation in the udder tissue and the pus formed comes away through the teat duct on stripping and through the udder wall when the abscess bursts externally.

CONTAGIOUS ABORTION.

Contagious abortion is an infection disease and is due to a specific micro-organism. The disease is a powerful predisposing factor in the production of sterility and every care should be exercised by stock owners to limit the spread of this disease. Full information as to symptoms, diagnosis, and treatment may be had by referring to the leaflet issued by the Department of Agriculture on this disease.

VAGINITIS.

Vaginitis.—Inflammation of the vagina—(the vagina is the passage which leads from the mouth of the womb to the exterior). This passage is frequently the seat of inflammation. When the inflammation of the vagina is acute, the affected animal will show symptoms of the irritation by frequent straining and frequent passing of urine. Very often the inflammation is accompanied by pus formation in which case a more or less purulent or muco-purulent discharge is present, the pus being expelled during the act of straining. In this condition the amount of pus discharged is very often so small as to escape notice unless a close examination is made.

Vaginitis can be caused by careless methods adopted in assisting the cow to calve, such as wounding the passage lining which is very sensitive and intro-

ducing infection into the vagina at this time by unclean hands or instruments. Again it may exist in a dairy herd in the form of an infectious disease when several cases will then appear. From this point of view of sterility the latter form is the more serious as the bull will act as an agent in the spread of the trouble. In the contagious form the lining membrane of the vagina in affected animals will be reddened and studded with numerous small pimple-like enlargements, a purulent discharge will also be present and in the acute stages straining will be evidenced by the affected animal after service by the bull or on passing urine. The inflamed membrane can be easily made to bleed so that the discharge from an affected cow will often be found to be blood stained.

This disease when present in a dairy herd will prevent conception in affected animals. The disease is more common in maiden heifers than older cows.

Treatment.—Affected animals should be isolated and douched with an antiseptic solution—corrosive sublimate in water—1 in 2,500 parts of water. Douching should be carried out twice daily until the acute symptoms subside.

To prevent the disease spreading the bull should, not be allowed to serve cows which are infected. If it happens that the bull has had contact with affected animals the hairs at the opening of the bull's sheath require to be clipped short and the sheath syringed out with the solution as recommended in the case of cows so affected.

TUBERCULOSIS.

When tuberculosis of the genital organs in the cow is the cause of sterility—treatment is out of the question. Prevention of this disease by slaughtering affected animals in a dairy herd is the best measure to take in such cases.

ACIDITY OF THE VAGINA.

Where acidity of the vaginal secretion is present in a dairy cow the service of the bull is effectively negatived. An acid state of the vaginal secretion in the cow does not give rise to any definite symptoms, and its presence will only be detected on a test being made for acidity by means of litmus paper or other chemical tests. Treatment when this condition is diagnosed douching of the vaginal passage with a solution of bicarbonate of soda—one ounce dissolved in a pint of water—will neutralize the acid present. This should be done daily for three days before the onset of heat, and on the day of service one hour before the cow is allowed to the bull.

STOMACH WORMS IN SHEEP.

Address to the South-West Conference, June, 1930, by E. F. TWADDLE, M.R.C.V.S.

The adult stomach worm of the sheep is found in the abomasum or 4th division of the sheep's stomach. Here in a badly infested animal the worms will be found in enormous numbers, either mixed with the ingesta of the stomach or adhering to the lining membrane of the stomach wall.

Life History.

After copulation has taken place within the stomach of an infested sheep fertilized eggs are laid by the female worm and passed out with the droppings

of the sheep onto the pasture. On the pasture the worm eggs—under suitable conditions of temperature and moisture—will hatch out within a period of twenty-four hours. The small embryos which thus come to life on the pasture moult twice during the first three weeks of life and having moulted are ready to infest and re-infest sheep on being taken into the alimentary tract with the food. On being taken up with the food of the sheep and reaching the stomach the immature worm continues to develop for a period of two or three weeks after which the adult sexually mature worm is developed and the next generation of worms is started. Thus in a period of six weeks the third generation of stomach worms come to life.

The size of the adult stomach worm varies from one-third to half an inch in length.

Symptoms.

Sheep which are not badly infested with worms show no marked symptoms of the trouble, but where heavy infestation occurs the affected sheep rapidly lose condition, and appetite, and progressive weakening of the affected animal and diarrhoea of a spasmodic nature sets in. As the condition progresses symptoms of anaemia with puffy swellings under the jaws appear, and finally death takes place when the sheep reaches the last stages of exhaustion due to the anaemia caused by large numbers of the parasites present in the stomach.

In sheep which die from worm infestation post mortem examination of the animal reveals the chief changes to be present in the 4th compartment of the stomach and that portion of the small bowel which leads directly from the stomach. In very acute cases the carcase will be found to be very well nourished. The liquid contents of the 4th stomach reveal great numbers of small worms.

Treatment.

In outbreaks in sheep the sheep should if possible be removed from the affected pastures so as to reduce further infestation. As older sheep often harbour the parasites without showing any marked symptoms, lambs should not be pastured over the same paddocks as the older sheep after weaning. Moist pastures are more dangerous to sheep in this matter than those which are comparatively dry—proper drainage of all pastures used by sheep will in a great measure prevent serious infestation of the ground with worms.

In districts where the trouble is serious all sheep and lambs should be dosed three times every season with a solution of copper sulphate and better with a mixture of a solution of copper sulphate and mustard. This medicine is prepared in the following manner:—Take ¼lb. of crystals of copper sulphate (blue stone) and dissolve in a pint of boiling water, take also ¼lb. of mustard and mix thoroughly with sufficient water till the mixture is thoroughly fluid, then mix the copper sulphate solution and mustard mixture together and make up to three gallons with water, using earthenware vessels for preparing and containing the mixture. Prior to dosing, the sheep should be starved for a period of 12 hours. Dose:—Lambs, 3 to 6 months, ½oz.; 6 to 9 months, 1oz.; 9 to 12 months, 1½oz. Sheep, over 12 months, 2oz. to 3oz.

In addition to drenching, sheep which are weakened through the effects of the parasites, should be allowed a liberal supply of concentrated food in addition to the pasture, such as oats, crushed or whole.

FIELD PEAS AS A ROTATION CROP IN THE SOUTH-WEST.

Address to the South-West Conference, June, 1930.

J. H. BRETT, Dardanup.

Many years ago there existed a feeling of pessimism and depression associated with the belief that a large dairying industry could never be built up in our South-West. Through the introduction of Subterranean Clover, and top-dressing with superphosphate—the advent of which two agencies have made a wonderful change in the outlook for the future—this feeling was dispelled. Consequently when we are again faced with a drop in values for our farm products, and when again it has become necessary to dispel a certain amount of depression, efforts must be renewed to show that our production can be still further increased. This does not mean an increase of acres cropped to produce a greater return for each head of stock, but an increased yield per acre to increase its stock carrying capacity, and thereby cut costs. This can be attained by the more general adoption by farmers of rotation cropping with field peas, thus ensuring the basic principle of agriculture, viz., the permanent fertility of our lands, and, as a natural corollary, financial stability.

We have read and know of lands in our Wheat Belt which became "wheat sick," and in the South-West "sheep sick" and "clover sick," with the resultant encroachment of the harsher and less nutritious grasses, such as Spear and Barley grasses in our clover pastures, calling for a system of farming that will remedy such defects. To achieve this a system of rotation with Field Peas as an annual essential crop is recommended. This recommendation is based upon personal success obtained during the past years when the only variety of Pea used was that known as the Brunswick White Field Pea. Of this type two varieties which I have called the "Large White" and the "Small White" have been grown by me.

The "Large White" is of a true white colour and large grain, and makes a very luxuriant growth with a small proportion of pods to the haulm. Blossoming and podding is, mostly, at the top of the plants, and takes place three weeks later than is the case with the "Small White." The yield is from 5 to 6 bags of grain to the acre. It is, however, more susceptible to grubs, and more expensive to harvest, owing to the larger proportion of haulm to pods. It is very suitable as a silage crop or ploughing in for humus.

The "Small White" is not true to colour, and has a smaller grain, is harder, and more dwarf in growth, blossoming and podding for weeks. From bottom to top the plants are literally smothered with pods, where conditions are favourable. It is less susceptible to grubs, and yields 8 to 10 bags to the acre. Owing to the bigger proportion of pods to haulm it is less expensive to harvest, and of the two varieties is the more suitable for our South-West conditions.

Obviously the most important question to farmers is "What is the crop worth?" This question is answered, from my own experience, under two headings —Firstly, the direct return obtained, meaning the quickest way in which the crop can be turned into cash; Secondly, the indirect returns to be obtained by feeding the crop to dairy cows, pigs and sheep by the benefit available to succeeding crops and the advantage of this rotation crop in the general routine of mixed farming.

1. *Direct Returns.*—Taking last season's crop as a typical example, an area of 30 acres was planted. Seed 2 bushels per acre. Superphosphate 1½ cwt. per acre. Yield 220 bags. Price realised 27s. per bag. Total £297.

Expenses of cultivating, planting and harvesting £3 per acre. Total (including seed and manure)—£90.

Net profit £207.

Sheep fattened on seed left on ground after harvesting—120. Net profit 5s. per head. Total £30.

Total net profit £237.

Based on the ruling price for peas in past years a net return of £6 to £7 per acre should be obtained. Expenses are heavier under the system of harvesting by raking, carting and threshing with horse and roller, as compared with the more modern method of the harvester with pea harvesting attachment. The capital outlay for the modern machine is too much for the small grower. A saving in bags can be effected by the use of washed superphosphate bags for the grain.

2. *Indirect Returns.*—Feeding the whole crop to sheep. A fair crop should fatten 15 to 20 sheep per acre. If crossbred wethers or lambs are bought right these should return £5 to £6 per acre. Feeding off the whole crop of peas is not favoured, as, if heavy rains should fall, with 15 to 20 sheep to the acre, many peas would be trodden into the ground, some of which would germinate and develop mouldy conditions, causing a loss of sheep, but, as hurdling and division fences are an expense, the whole crop may have to be fed off as one unit, and in such a case it is advisable to rake into windrows. The sheep will pick up the peas between rows and nose them out of the windrows, which, if wet with rain, would soon dry out again. The rake could be again used to turn them, if necessary.

Dairy Cows.—In my experience cows never milked better or gave more cream than when ground peas were added to the ration. Ground peas are a concentrate next to linseed in value.

	Peas.	Linseed
Protein	19·4	19·4
Fat	1·0	34·7
Carbohydrates	49·9	18·0
Food units	101·0	155·2

My experience has been that peas can be stored as they are not attacked by mice or weevils.

Peas are one of the best concentrates in a ration for the putting on of solid meat. Butchers say that stock fattened on peas weigh out best. Peas can be fed whole or ground, mixed with the swill.

An important series of feeding and milling tests with pigs at Roseworthy College, South Australia, proved a ration including a mixture of barley, peas and wheat to be the most economical of those added to the basal ration of pollard and skim milk.

Increased values to succeeding crops.—Any succeeding crop does benefit from the nitrogen fixing habit of the legumes, and this is shown by their deep green colour. Oats for hay after peas stands feeding off two or three times, and then after shutting up for harvest cut 30 to 40 cwt. per acre; in some cases an additional yield of 1 ton per acre. The extra ton per acre this season meant all the difference between profit and loss on the ruling price of chaff.

The ground is most friable after peas and there is no need to wait for rains before ploughing with the disc and planting the succeeding crops.

Rotations.—It is possible (and has been done under our South-West conditions of heavy rainfall) to obtain three crops off the same ground in 12 to 14

months, where pea growing is included in the rotation. Thus, October to March—Maize and Sorghum; April to June—Burt's Early Oats or Barley; July to November—Peas. It is believed that such rotation will not exhaust the fertility of the land as two of the crops are fed off on the farm, as is a proportion of the peas.

Rotation 2.—Pasture after top-dressing with 1 cwt. superphosphate per acre in March. Grazed until the end of June and then planted with field peas. Peas growing from July to end of November, then harvested and fed to sheep, with grain on ground from January to April. Ploughed and drilled with oats and Subterranean Clover for feeding off, and later cut for hay in December. Summarised this rotation is—Peas, Oats and Subterranean Clover pasture.

Their advantage in general routine of mixed farming.—A paddock of peas, when raked safe from fire and used as a standby for sheep, can be threshed when convenient and is safe in windrows.

It permits the dairyman to fatten sheep as a profitable side line, without affecting the cow pastures; also, to turn over money on the three months' bill for sheep, which are sold when the first rains appear, and natural pastures for cows make growth.

SUMMARY.

1. A systematic rotation adhered to will increase production:
2. Make field peas one of the crops in the rotation:
3. Sow not less than 2 bushels per acre and 1½ cwt. of superphosphate on well drained land. A light loam is ideal;
4. Harvest portion of crop; feed to sheep what is left;
5. Put in oats and clover for cows;
6. Feed off and shut up for hay.

In conclusion let me say that the Legume family, to which peas belong, fix nitrogen from the air. There is thus an inexhaustible supply of what in wartime is the base of the most deadly explosives, but in peace, the base of all foods. As the old prophet Micah foretold of that age when "they shall beat their swords into plough shares," so may we look to that day in these times when scientific research on the potent element nitrogen will not be for the purpose of destroying life, but, by agricultural research, for the more and abundant production of plant life, so that "the desert shall blossom as the rose" and the dawn of that great day of "Peace on earth and goodwill towards men."

"THE JOURNAL OF AGRICULTURE"

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CHEAP FACE-CUT SILOS AS USED IN THE MANJIMUP-JARDEE DISTRICT.

M. CULLITY,
Agricultural Adviser.

With the continued progress in the dairying industry and the considerable decline in many phases of farming from which farmers formerly derived portions of their income, more attention is being given generally to the getting of the maximum profitable production from dairy stock. To do this one of the matters receiving attention is production during our dry season, during which time there is a considerable decline in milk and cream production.

This sudden drop in production is a serious one for the farmer whose cows calve late, for those also who make a practice of calving down in spring. Those who arrange the freshening of their cows for the months April-June do not suffer to near the same extent; in fact they nearly escape its effect altogether, as this slump period would more or less coincide with the drying off of their stock.

For those, however, who wish to carry their cows in milk through this period, it is necessary to provide a succulent feed. This may be done in three different ways:—

1. By providing an area of permanent pasture as could be obtained on suitable locations with a mixture of some of the following:—

   Paspalum dilatatum,
   Paspalum distichum,
   White Dutch clover,
   Strawberry clover,
   Lotus major.

2. By growing fodder crops for feeding in the green state, crops such as maize, lucerne, sorghum, Sudan grass, etc., being suitable for this purpose.

3. By providing silage.

In all cases, of course, it is imperative to provide a sufficiency of good water.

It is the intention in these notes to describe one method of making silage, which has been practised with success in the Jardee district near Manjimup. This is by the conservation of fodder in a face-cut silo, the name face-cut being the trade name for certain pieces of timber which are rejected as unfit for ordinary sale. They are obtained in the turning of logs in milling, in which process the log is cut back until all defective timber is cut out. The planks are very suitable for the purpose to be described, the only defect in many being an occasional gum streak which prevented its use commercially.

In the district mentioned above, farmers are fortunate in having timber mills situated not many miles from their holdings, and so are in a position to cart any material purchased, thus saving a sum that in their circumstances is considerable.

The silo as erected is square, having usually 8 to 10 feet sides. The construction is very simple, and may be seen in a glance at the accompanying photographs. Four corner posts are erected, round bush poles being just as suitable

as sawn timber. Cross bearers are inserted on the inside of the posts in a horizontal position. The face-cuts are then fastened vertically to the inside of these, and arranged so as to have as smooth a surface as possible inside.

The cost of the silo is very small; an idea of it may be obtained from the following figures given by Mr. W. Kjellgren, of Middlesex, Jardee. His silo is 8 feet square and in all is 17 feet in height, but, as it has been erected in an old pit 6 feet deep, it stands only 11 feet above ground. The materials for this were as follow, Mr. Kjellgren making no allowance for his own labour, being concerned only with the actual amount of cash having to be paid out:—

	£	s.	d.
32 face-cuts 17ft. x 1ft. x 1in., at 1s. each	1	12	0
9 feet 4in. x 2in.	0	12	0
Nails, 4 to each board on each batten	0	6	0
	£2	10	0

Labour charges were not made, as Mr. Kjellgren contended that the whole was erected during slack periods, and periods of broken time when no other useful work could have been attempted.

Another farmer using this same type of silo is Mr. W. Cox, of Jardee. In this case the dimensions were 9ft. x 9ft. x 18ft., the bottom of the silo being 4 feet below ground level. The face-cuts used were wider than those obtained by Mr. Kjellgren, being up to 18 inches in width, and the consequence is that more warping has taken place. Mr. Cox intends to either replace these warped boards with narrower ones, or split them, giving a better hold on to the bearers, minimising the tendency to warp.

The cost of this silo without labour charges was £4, including bearers, face-cuts, nails, and cartage from the Jardee mill, approximately six miles.

This past season Mr. Cox ensiled six acres of crop, comprised of four acres of light oats and subterranean clover, being the first crop on this paddock, and two acres of good subterranean clover. The result was excellent. No estimate of the amount of waste was made, as a considerable amount of good silage was not used, owing to the method adopted for unloading the silo. An axe was used to chop out the silage, with the result that nearly as much good silage as there was waste was discarded. A better method would have been to take off the silage required in layers, throwing the rotten and mouldy material on one side.

An illustration of this silo is shown below.

Mr. G. F. Combs, of Jardee, is another who has been particularly successful in using this type of silo. This silo was estimated by Mr. Combs to have cost £7, including the charge for labour used in its construction. This one differs from those previously described in that it is wholly above ground and that, in general, narrower boards have been used, mainly flooring board size.

Mr. Combs also has a cement brick silo with cutter and blower. Last year time did not allow him to fill the concrete one, but the previous year both silos were used, and I had an opportunity of comparing the results. Of course, the cutter and blower were used in filling both. The results were amazing. The loss in the expensive structure was estimated at 5 per cent., while in the other face-cut silo the loss was only 2 per cent. greater, or a total of 7 per cent.

The following farmers also use this type of silo:—

J. Crawley, Jardee.
H. Grumpelt, Deeside Road.
E. W. Abbott, Jardee.
S. E. Beasland, Jardee.
G. Dodson, Jardee.

Mr. Grumpelt was probably the first to use this system, and has now had silage for the last seven years. He is entirely satisfied with his results.

Illustration I.—Facecut Silo erected by Mr. W. Cox, Jardee.

This silo, 10 feet long, 8 feet wide, and 16 feet high, takes usually from seven to 10 days to fill. The silage has always been cut the first week in November and has averaged five tons to the acre. With reference to its value in feeding to milch cows, Mr. Grumpelt says it maintains the milk flow and keeps his cows in a healthy condition.

Mr. Crawley has used the method for the past five years, with very similar results to those obtained by Mr. Grumpelt.

In the 1928-9 season a comparison was made by the writer of the measured loss in these silos as against the measured loss in open stacks. There were some

very bad attempts at making silage by both methods, but the worst failure with the face-cut silo could not be compared with the loss made in several stacks. Much of the loss was caused by lack of knowledge of the process of ensilage, crops being cut too late, left too long before carting in, and bad stacking and trampling being responsible in many cases for building up the waste beyond a reasonable figure.

The summary of the comparison above referred to showed that the average loss in the face-cuts was one-half only of the loss in the stacks. One or two stacks inspected were complete failures, while the worst fact-cut was better than the best stack. I am referring here still to the amount of loss, not wishing to make any comparison between the quality of the silage made by the two processes.

The disadvantages most frequently quoted against this system is that of difficulties in filling and emptying. This seems really great, but only then when compared with the stack, and even then the disability appears greater than is actually the case. In the stack the material is forked direct from the cart or sledge on to the top of the stack, while, in the other type, the filling takes place either over the top of the structure or else through the doors which are left in the better type. A whip-stick arrangement is used by Mr. Grumpelt for filling, while Mr. Crawley has a special loading fork and derrick. The unloading problem where doors are left at convenient heights is no different from that of a stack.

A few points that assist in reducing waste by this method are enumerated below:—

1. When wide face-cuts are used, they should be secured to the battens their whole width, otherwise warping will occur which will allow more air to reach the curing silage. Where green boards only can be obtained, it is much preferable to use narrow boards, as the tendency to warp is minimised.

2. The vertical boards should be as close together as possible so as to exclude air.

3. Where possible it is advisable to have the bottom of the structure below ground, as air is completely excluded in this portion. Four or five feet below ground level is not inconvenient.

4. Some of the waste in the square corners may be eliminated by placing in the angle about the position of the cross bearers a small batten, to which face-cuts may be nailed on the inside, so doing away with the right-angle corner as shown.

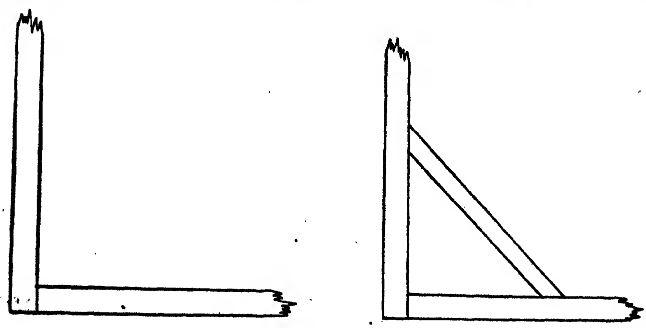

Illustration II

The following applies to stack, pit, and other methods of ensiling:—

5. The crop should be cut early. Where ordinary pastures are concerned, cutting may take place late in September or early in October. Less waste will result from silage made at this season than would be the case with later cutting. Cutting earlier than this would result in a too sappy or mushy silage with a considerable loss in feeding value.

The farmer in any case must arrange his work so that his ensilage season is finished before his paddocks are ready to cut for hay. Once the time for hay-cutting arrives, the farmer's energies are more profitably devoted to making hay.

6. Only as much material should be cut in one day as can be carted in and placed in the silo on that day. The usual method on most small farms is to cut in the morning and cart in during the afternoon.

7. The material first cut should be first carted.

8. In loading the silo, the material should be spread evenly and well trampled, paying most attention to the sides and corners. When leaving at night have some handy weights close by for laying on top. A few planks and sand-bags serve the purpose; when full cease cutting for a while till subsidence takes place. A convenient method of deciding when to recommence loading is to wait till the heat generated in the material can be felt in the top layer. This applies more particularly to where the material can be carted in fast. This filling and waiting to sink has to be continued for some time. Of course, the more carefully this is done, the more material ensiled and the better the resulting material will be.

With reference to the feeding value of the silage so made as compared with that from other systems of making silage, little information can be given. From analyses made early in 1929, it would appear that little difference exists between the various methods.

The table given below shows the analyses of silage made by various methods and approximately at the same time. Unfortunately no data is available regarding the crops ensiled. Subterranean clover was the basis of all the mixtures, but the variation in the amount of grasses and weeds present was not noted.

——	Type.	Per-centage Water.	Ash.	Nitro-free extract.	Sulphuric Ether extract.	Album-inoids.	Fibre.	Unit Value. Guthrie.
G. F. Combs	Concrete	68·6	3·53	13·3	1·45	4·01	9·11	20·57
	Face-cut	65·7	3·42	13·36	1·87	5·43	10·21	23·00
* 6	Stacks ...	70·9	3·09	12·22	0·84	4·05	8·90	18·16

* Stack Silage. Leaflet No. 295, by G. K. Baron-Hay, Department of Agriculture, Western Australia.

In conclusion, the following remark by Mr. W. Cox as the value of silage is of interest:—

"I found that the flow of milk was greater, but the remarkable thing was the healthy condition of my stock, all my cows retaining their sleek appearance throughout the summer months."

KAPOK.

The Government Botanist, Mr. C. A. Gardner, is in receipt of a communication from a Fremantle resident who seeks information regarding kapok, and suggests that as a matter of general interest the reply be made through the *Journal of Agriculture*. In response Mr. Gardner has supplied the following information.

Kapok comes from the tree *Bombax malabaricum,* found in tropical Asia and northern Australia and seeds could be obtained in Perth. It would not, however, grow here, since it is purely a tropical one and unsuited to cold conditions, growing in rich soils which are well drained. (Basaltic soil in the Kimberleys.) There is a class of kapok made from cotton, which is cheaper than the true kapok.

A shrub growing at Chidlows, and described by the correspondent, is evidently the so-called "Duck Plant" or Cotton Bush (*Asclepias fruticosa*), which is altogether different in type from the true one, the silky substance contained in the pods having no staple and easily breaking up. It is doubtful if this would be of any value even for stuffing, and its growth should not be encouraged, as it is apt to become a weed, while the silky substance of the seeds has no economic value.

NAREMBEEN AGRICULTURAL BUREAU.

100-Acre Fallow Competition, 1930.

Judge: R. P. ROBERTS, B.Sc.(Agric.), Agricultural Adviser.

There were 21 entries received for this fallow competition, the first of its kind conducted by the Narembeen Agricultural Bureau, and of which judging took place from the 10th-14th February according to the following scale of points:—

Moisture	40
Mulch	10
Freedom from weeds	10
Consolidation of seed bed	20
Uniformity of preparation	20
	100

The rainfalls recorded at various stations in the district are set out hereunder:—

Station.	1929.								1930.
	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	Jan.
Narembeen ...	220	365	203	108	81	85	216	...	...
Wadderin ...	339	363	257	134	25	37	282	4	...
Emu Hill ...	273	384	242	102	36	85	181	...	...
South Kumminin	247	377	225	121	30	33	260	...	...

The past season was not an ideal one for the preparation of good fallow. Excessive winter rains caused some of the heavier land to become too wet for the initial operation (ploughing), whilst the rapid drying-out in the spring did not allow sufficient time to work the land when in the desired condition for uniform work. The heavy falls at the beginning of November came at a time when farmers found it difficult to delay important work in hand in order to give attention to the fallow.

Despite these handicaps, however, some excellent fallows were submitted for inspection. The awards made are set out in the following table:—

NAREMBEEN AGRICULTURAL BUREAU.

100-acre Fallow Competition.

Competitor.	Address.	Moisture 40 pts.	Mulch. 10 pts.	Freedom from Weeds. 10 points.	Consolidation of Seed Bed. 20 points.	Evenness of Preparation. 20 points.	Total. 100 pts.
Mortimore, R. ...	Wadderin ...	35	9	9	18	19	90
Burgin and Yeoman	Wadderin ...	34	8	9	18	19	88
Dayman, G. S. ...	Emu Hill ...	33	8	9	18	18	86
Smith Bros. ...	C. Kumminin	33	8	9	18	17	85
Tucker, C. H. ...	S. Kumminin	36	7	9	14	18	84
Ruse, E.	Narembeen ...	34	7	9	18	16	84
Howell, A. ...	Mt. Arrowsmith	33	8	9	17	16	83
Hebberman, H. ...	Emu Hill ...	32	7	8	18	18	83
Berry, A. ...	Wadderin ...	33	8	7	16	18	82
Fricker, W. H. ...	Narembeen ...	28	9	9	17	18	81
Gibbings, T. E. ...	Mt. Arrowsmith	29	8	9	16	18	80
Cheetham, R. (No. 1 Entry)	S. Kumminin...	29	7	9	16	18	79
Price, J. H. ...	Narembeen ...	27	7	9	16	17	76
Cavanagh, F. O....	Hedges Siding	27	8	8	15	18	76
Savage, T. P. ...	Narembeen ...	26	8	8	16	17	75
Smith, N. ...	Emu Hill ...	29	7	9	15	15	75
Hewett, R. F. ...	Wadderin ...	32	6	8	14	15	75
Draper, A. T. ...	Narembeen ...	28	7	7	15	16	73
Cheetham, R. (No. 2 Entry)	S. Kumminin	27	6	7	16	16	72
Northmore, C. ...	Narembeen ...	25	6	9	13	17	70
Yandle, F. ...	S. Kumminin...	28	4	8	12	16	68

First place was gained by Mr. H. Mortimore, whose competing area was ploughed in July to a depth of 3½in.-4in. with a mouldboard plough. This entry was portion of 170 acres in the same paddock, the whole of which had been treated in uniform manner.

The land, which originally carried Salmon Gum, Gimlet, Tea-tree, and a little Morrell, was ploughed during the period end of June to middle of July. It was scarified with a rigid tyne cultivator the second week in September. After the rains in November, half was cultivated with a rigid tyne cultivator and half with a springtyne implement. As no rain had fallen subsequent to this latter cultivation the mulch was in an excellent condition, being loose, dry, and well corrugated. Weeds were almost totally absent, and the moisture content was good. The generally even and uniform appearance of this entry is worthy of comment.

Messrs. Burgin and Yeoman gained second place with an entry which was rigid-tyne scarified in June to a depth of 4 inches. It received further cultivations with the same implement in September and November. This piece of fallow was also almost entirely free from weeds and had a good level seed bed. The moisture content was good, but the mulch was, if anything, a little too deep.

The cultural methods employed by the competitors are set out in the following table:—

NAREMBEEN AGRICULTURAL BUREAU.

100-ACRE FALLOW COMPETITION.

Competitor.	Address.	Original Timber.	Time of Fallowing.	Type of Plough.	Depth of Ploughing.	Condition of Land at time of Ploughing.	Cultivations.	Sheep.
					inches.			
Mortimore, R. ...	Wadderin	Salmon gum, gimlet, tea-tree and morrell	July ...	Mouldboard ...	3½ to 4	Good ...	Springtyne cultivated in September. Part springtyne cultivated and remainder scarified after rain in November	Yes
Burgin and Yeoman	do. ...	Salmon gum and gimlet	June ...	Scarifier ...	4	Good ...	Scarified in August and again in November	Yes
Dayman, G. S. ...	Emu Hill ...	Salmon gum, gimlet and a little tea-tree	June–July	Rigid tyne cultivator	3	Good ...	Cultivated with a rigid tyne implement at the beginning of August. Springtyne cultivated in September	Yes
Tucker, C. H. ...	South Kumminin	Gimlet with some mallee and tea-tree	June–July	Disc ...	3 to 3½	Wet ...	Ploughed again in August	No
Smith Bros. ...	Central Kumminin	Salmon gum and gimlet	June–July	Mouldboard ...	4	Good ...	Harrowed in June and again at the end of July. Part scarified and harrowed, and remainder springtyne cultivated first week in August. Part harrowed at beginning of February	Yes
Luse, E.	Narembeen ...	Gimlet, mallee and tea-tree	June–July	Disc (Sundercut)	3 to 3½	Good ...	Scarified at end of July and again in middle of August. Part scarified again in November after rain	Yes
Howell, A.	Mt. Arrowsmith	Salmon gum and gimlet	June ...	Mouldboard ...	4	Good ...	Springtyne cultivated in September. Scarified in October	Yes
Hebberman, H. ...	Emu Hill ...	Salmon gum and gimlet	End of June	Mouldboard ...	2½	Good ...	Cultivated with a disc implement (Sundercut) in July. Springtyne cultivated in August. Half-springtyne cultivated and remainder harrowed after rains in November	Yes
Berry, A.	Wadderin ...	... ...	...	... ...	...	...		
Fricker, W. H. ...	Narembeen ...	Mainly gimlet ...	June ...	Mouldboard ...	4	Good ...	Cultivated with a springtyne implement the first week in August, the second week in September and the last week in November	Yes

NAREMBEEN AGRICULTURAL BUREAU—*continued.*

100-Acre Fallow Competition—*continued.*

Competitor.	Address.	Original Timber.	Time of Fallowing.	Type of Plough.	Depth of Ploughing.	Condition of Land at time of Ploughing.	Cultivations.	Sheep.
					inches.			
Gibbings, T. E. ...	Mt. Arrowsmith	Salmon gum, jam, mallee and white gum	July ...	Mouldboard and disc (Sundercut)	4	Wet ...	Springtyne cultivated in September and again after rains in November	Yes
Cheetham, R. (No. 1)	South Kumminin	Gimlet, salmon gum and mallee	End of June	Mouldboard ...	3	Rather wet	Cultivated with a disc implement at the end of August. Harrowed in September	Yes
Price, J. H. ...	Narembeen ...	Salmon gum, gimlet and mallee	June–July	Mouldboard ...	3	Fair ...	Cultivated with a disc implement in August. Harrowed in September. Springtyne cultivated after rain in November	Yes
Cavanagh, F. O. ...	Hedges' Siding...	Salmon gum and gimlet	July ...	Mouldboard ...	4	Fair ...	Cultivated with a disc implement in July. Springtyne cultivated in September	No
Savage, T. P. ...	Narembeen ...	Gimlet and morrell ...	July–August	Mouldboard ...	3½ to 4	Rather dry	Springtyne cultivated in November. Half springtyne cultivated at the end of January	Yes
Smith, N	Emu Hill ...	Gimlet, Yorkgum, and mallee	June ...	Mouldboard ...	4	Good ...	Cultivated with a disc implement (Sundercut) in July. Cultivated in August with a Springtyne implement and again in November after rain. Harrowed immediately after the latter cultivation	Yes
Hewitt, R. F. ...	Waddering ...	Gimlet, tea-tree and salmon gum	July ...	Disc (Sundercut)	3	Very wet...	Harrowed first week in August. Cultivated with a disc implement (Sundercut) at the end of August	No
Draper, A. T. ...	Narembeen ...	York gum and jam ...	July ...	Disc (Sundercut)	4	Fair ...	Cultivated with a disc implement (Sundercut) in September	No
Cheetham, R (No. 2)	South Kumminin	Gimlet, salmon gum and mallee	June ...	Mouldboard ...	3	Good ...	Cultivated with a Springtyne implement at the end of July and again in September	Yes
Northmore, C. ...	Narembeen ...	Salmon gum and gimlet	June ...	Rigid tyne cultivator	3	Good ...	Crossed with rigid tyne cultivator in July. Cultivated with a disc implement (Sundercut) and springtyne cultivated in October	Yes
Yandle, F.	South Kumminin	Gimlet, salmon gum and mallee	August ...	Mouldboard ...	4	Wet ...	Half harrowed and springtyne cultivated in September. Remainder springtyne cultivated after rain in November	Yes

A study of the above cultural details reveals several points of interest.

It will be noted that over 75 per cent. of the competitors had sheep depastured on their fallow during the year. This, in conjunction with the dry summer, resulted in most of the competition plots being almost completely free of weed growth. Practically the only weed noticed was "Potato Weed" (*Solanum hoplopetalum*), which, owing to its prickly nature, is not eaten by the sheep. In addition to controlling weeds, sheep are of great value on account of their tramping over the fallow, assisting to compact the seed bed.

The type of plough most favoured was the mouldboard. Different types of ploughs have their own slight advantages and disadvantages on different classes of soil. However, the type of implement used is not of great importance as long as the work is done thoroughly and evenly.

On the lighter soils good work can be done with the rigid tyne cultivator or scarifier, provided the land surface be clean and free of weeds.

Experiments have shown that there is no advantage gained by ploughing deeper than four inches. On the other hand, it is doubtful whether uniform and effective work can be done when attempting to plough at depths much less than this.

Fallowing should be completed as early as possible during the winter months. Experiments over a number of years have shown that August fallow is definitely inferior to that fallowed in June.

For subsequent treatment of the fallow there seemed some considerable difference of opinion concerning the most suitable implements to use. It is not possible to lay down hard and fast rules, as so much depends upon the vagaries of the season and the class of soil being dealt with. However, an attempt has been made below to give an outline of the general principles which have been found most suitable for application in the Western Australian wheat areas.

It has been definitely established by experiments carried out at the Merredin Experiment Farm that it is more profitable to fallow early during the winter months. The results of the experiments referred to show that over a number of years June fallowing is approximately 25 per cent. better than August fallowing. For this operation the type of plough to use is not material. The implement used depends on the nature and condition of the land to be worked, but whatever implement is selected, it is important that the work be done thoroughly. It is generally found that more thorough work can be relied upon when the mouldboard is used.

Before and after the ploughing operations, the land should be fed bare with sheep. This permits of the implement doing better work, and reduces the number of subsequent cultivations required to control weed growth.

The number of cultivations given to the fallowed area will depend upon weed growth and rainfall. The object in view is to destroy weed growth and maintain an even mulch of about 2in. deep, not too fine, but well corrugated.

Another experiment carried out at the Merredin Experiment Farm for the past 14 years shows that numerous cultivations during the summer are not advantageous, except to destroy weeds, and after heavy rains which cause the mulch to become hard and set. The results of the experiment, however, show that it is advantageous to cultivate in the spring and before planting.

Under normal conditions the springtyne cultivator is suitable for these cultivations. For the first operation, usually at the latter end of August and during September, the cultivation should be to the full depth of the ploughing. The object of this deep cultivation is to bring to the surface clods which had been ploughed under and which otherwise would have hindered the consolidation and tended to the formation of air pockets. The vibration and combing effect of the springtyne cultivator make this machine ideal for this work; the finer particles are sifted down to fill the spaces originally occupied by the larger lumps, thus assisting in the formation of an even and compact seed bed.

Subsequent cultivations should be carried out only when required after heavy rains to kill weeds and maintain the mulch. The depths of such cultivations should be about two inches, but should weeds be present the depth may need to be increased to destroy them. For larger weeds, and when the ground has become hard and set, the springtyne implement is not always suitable. Under such conditions a heavier implement is necessary. The disc cultivating type of plough and the rigid tyne cultivator are suitable. The objection to the former is that it has a tendency to bury the larger clods bringing the finer soil to the surface. Thus the mulch becomes too flat when it more readily becomes hard and set after further rain.

After lighter falls of rain during the summer, when weed seeds germinate, the harrows are useful to destroy the young seedlings, but they are of little use for the larger weeds. They tend to make the mulch too fine and flat, and if not attended to with a tyned cultivator immediately after heavy rain, difficulty will be experienced in securing the desired uniform tilth at seeding time.

When a combined cultivator seed drill is not used the land requires to be cultivated prior to seeding, preferably with a springtyne implement to a depth of about two inches.

At seeding time the fallow should be free of weeds with the mulch two inches deep, uniform and not too fine, but the surface will be corrugated. The presence of surface clods the size of one's fist and smaller is ideal. The subsurface soil should be moist, compact and firm, but not hard.

FIFTY ACRE FALLOW COMPETITION, 1929-30.

BRUCE ROCK AGRICULTURAL SOCIETY.

Judge—G. E. THROSSELL, Agricultural Adviser.

Eight farmers submitted their fallows for this competition, and although this number was two less than the previous year, as the table of points indicates, the standard maintained in the competition was high. Two new competitors participated this year, the others being consistently ardent supporters of fallow competitions. It is rather surprising that more farmers in the Bruce Rock district do not enter.

The same scale of points as adopted in previous competitions was used this year.

The following table shows the rainfall recorded from June to the end of February, during which month the judging was done:—

—	Fallowing rains.				Spring rains.			Summer rains.					Total rain on fallow.
	June.	July.	Aug.	Total.	Sep.	Oct.	Total.	Nov.	Dec.	Jan.	Feb.	Total.	
Bruce Rock ...	312	216	120	648	21	41	62	233	3	...	...	236	946
Babakin ...	355	180	82	617	26	57	83	211	2	...	3	216	916
Central Kumminin Bungulluping	335	184	110	629	28	31	59	164	...	...	...	164	852

Good rains fell during the fallowing period, June being a particularly wet month. The spring rains were practically negligible, and on account of harvesting operations the heavy rains early in November could not be utilised to full advantage.

The awards are set out in the table hereunder:—

BRUCE ROCK AGRICULTURAL SOCIETY.

FALLOW COMPETITION, 1929–30.

Awards.

Competitor.	District.	Points.					
		Moisture.	Mulch.	Absence of Weeds.	Consolidation.	Uniformity of Preparation.	Total.
		40 pts.	10 pts.	10 pts.	20 pts.	20 pts.	100 pts.
C. E. and N. S. Schilling	Bungulluping	36	9	9	19	19	92
Buller & Black ...	Babakin ...	36	8	9	19	19	91
F. C. Farrall & Sons	Yarding ...	36	8	9	19	18	90
Smith Bros. ...	Central Kumminin	36	8	9	19	18	90
P. A. Strange ...	Eujinyn ...	37	8	8	18	19	90
S. A. Brown ...	Bungulluping	35	8	8	19	19	89
Leah & Sons ...	Yarding ...	36	8	8	19	18	89
F. C. Farrall & Son	Yarding ...	35	8	9	19	18	89

The winners this year were the partners E. S. and N. S. Schilling, of Bungulluping, whose fallow scored 92 points. Only one point separated the runners up, Messrs. Buller and Black, of Babakin, whose keen spirit of healthy rivalry, year after year, deserves mention. That only three points should separate the first and last competitors shows the standard reached was a high one. It is noticed also when travelling about the district that a general improvement in the quality of the fallow can be seen.

An analysis of the cultural details of competitors has been prepared in the following table:—

Competitor.	Original Timber.	Years Cropped.	Rotation. Years.	When Ploughed.	Type of Plough.	Depth of Ploughing.	Cultivation.	Sheep.	Points Awarded.
1—C. E. & N.S. Schilling	Salmon Gum and Gimlet	?	3	June	Sundercut ...	3–4	Cultivated with a Sundercut July and August, with a combine drill in November	Yes	92
2—Buller & Black ...	Jam and York Gum	?	3	June–July ...	Sundercut ...	3	Harrowed July, scarified August and October	Yes	91
3—F. A. Farrall & Sons	Salmon Gum and Gimlet, Jam	5	3	Mid May ...	Mouldboard...	4	Reploughed with sundercut early August. Cultivated with a combine drill end August and with springtyne early November. Harrowed end November	Yes	90
4—Smith Bros ...	Salmon Gum and Gimlet	...	...	June	Mouldboard...	3	Harrowed June, scarified twice in August. Portion in November, balance with a springtyne	?	90
5—P. A. Strange ...	Jam, York Gum and Wattle	7	3	July-August ...	Mouldboard ...	3–4	Cultivated with a springtyne in September	Yes	90
6—S. A. Brown ...	Salmon Gum and Gimlet	9	3	July	Scarifier ...	3	Turned back with sundercut in September. Scarified in November.	Yes	89
7—Leah & Son ...	Salmon Gum, Gimlet and Morrell	7	3	June	Mouldboard...	3	Cultivated with a combine drill in July, August and October	Yes	89
8—F. C. Farrall & Sons	Salmon Gum and Gimlet	8	2	June	Mouldboard...	4	Springtyne cultivated in June, sundercut in August, scarified September, harrowed November	Yes	89

As mentioned previously, it was difficult to work the fallow after the early November rains on account of the harvest. After such heavy rains it is necessary to restore the tilth of the mulch, which should be at least two inches deep to be effective. Where harrows had been used the mulch was too fine and level, and on the shallow side.

The competing areas were very free of weeds this year, weather conditions during the spring being ideal for weed destruction, and now that sheep are more in evidence clean fallow should result.

When a cultivation with a disc implement has been found necessary, it is advisable to use for the next operation, a tyned implement. This leaves the mulch in a corrugated condition, and thus does not have such a tendency to "set" after a heavy fall of rain.

FIFTY ACRE FALLOW COMPETITION, 1929-30.

SOUTHERN MALLEE AGRICULTURAL SOCIETY.

Judge—G. L. THROSSELL, Agricultural Adviser.

For the first fallow competition conducted in the Esperance wheat area, by the Southern Mallee Agricultural Society, there were nine competitors. It was expected that a considerably larger number of farmers would have participated on account of the assistance which both the Agricultural Bank and the Department of Agriculture are giving to fallowing in this area.

Because of the variation in soil and climatic conditions in this area, the Agricultural Society decided to divide the competition into two sections, South and North. The Southern section was for those farmers located in the Esperance Road Board district, which receives a larger rainfall and where the clay soils predominate. The Northern section, defined by the Dundas Road Board area, has soils of a lighter nature and less rainfall.

The competition received better support from the South, Scaddan and Treslove supplying five of the six entries in this section, while in the North there were only three entries.

The points under which the competition was judged are as follows:—

Moisture	40	points.
Condition of Mulch	10	"
Absence of Weeds, Suckers, etc. ..	10	"
Consolidation of Seed Bed	20	"
Uniformity of Working and Thoroughness of Preparation ..	20	"
Total	100	"

The following table shows an analysis of the rainfall from the commencement of fallowing to the time of judging, which was done early in March:—

Place.	Fallowing Rains.				Spring Rains.			Summer Rains.					Total on Fallow.
	June.	July.	Aug.	Total.	Sept.	Oct.	Total.	Nov.	Dec.	Jan.	Feb.	Total.	
Scaddan ...	293	143	87	523	47	55	103	283	116	2	...	401	1,026
Red Lake ...	244	139	193	576	13	63	76	212	60	...	...	272	924
Salmon Gums	201	135	133	469	21	43	64	184	33	2	...	219	742
Dowak ...	217	130	88	435	13	38	51	153	53	2	...	208	694

The fallowing rains were up to average and the ploughing season finished with a good general rain at the end of August. The spring rains were conspicuous by their absence, and the heavy falls during November and December could not be utilised to full advantage on account of harvesting operations.

The following table shows the points awarded:—

Competitor.	Nature of Soil.	Years Cropped.	When Fallowed.	Type of Plough.	Depth of Ploughing.	Cultivations.	Points Awarded.
					inches.		
Southern Area (Esperance Road Board Area)—							
1.—Grigg Bros	Clay land	4	July ..	Disc ...	3 to 4	Cross-ploughed September; springtyne cultivated January	90
2.—H. H. Gurney ...	Sandy clay, fluffy patches	1	June ...	Disc ...	3 to 4	Cross-ploughed September; harrowed November	88
3.—W. F. Webster ...	Loamy sand	2	June ...	Sundercut ...	3 to 4	Cross-sundercut in December	86
4.—A. E. Erdman ...	Clay loam	1	August ...	Disc ...	3 to 4	Cultivated with a springtyne cultivator in September and November	85
5.—J. Anderson ...	Clay land	4	July ...	Disc ...	4	Cultivated with a springtyne end of September; harrowed after rain December and January	83
6.—H. Ibbotson ...	Sandy loam	New land	September ...	Disc ...	4	Reploughed in December	78
Northern Area (Dundas Road Board Area)—							
1.—Nulsen & Dunn ...	Sandy loam	1	July ...	Disc ...	4	Cultivated with a springtyne cultivator in September	89
2.—H. Paul	Sandy loam	...	... ...	... ...	...	... ...	87
3.—H. Arthurell ...	Sandy loam	New land	June ...	Sundercut ...	4 to 6	Harrowed in October	83

The Southern section was won by Messrs. Grigg Bros., of Scaddan, with an entry which scored 90 points. This fallow was also awarded the Championship for the whole area. The Grigg Bros. were among the pioneers of the district, and their well merited success will do much to focus the attention of others to the value of good fallow which, from experience, Grigg Bros. have found so necessary. A Departmental Field Trial, in the form of a Time of Seeding Experiment, has been planted on portion of this fallow.

Messrs. Nulsen and Dunn, of Kumarl, won the Northern section, scoring 89 points, and were placed second in the Championship.

It is not intended in this report to review fully the subject of fallowing, but to point out a few details which are either not generally appreciated or not fully understood.

Making a thorough job of the initial operation of ploughing is half the battle in the preparation of a good fallow. Subsequent cultivations will not entirely remedy faulty ploughing, nor can they wholly overcome the defects and achieve the results obtained from a thorough ploughing.

There are some in this district who have the idea that after ploughing, the land should be harrowed to "level it off and break the clods." This is exactly the opposite to what is required. During the winter, the surface of the fallow should be left in a rough condition in order to prevent it from running together and setting, as well as to enable as much rain to penetrate into the soil as possible. Once the surface has set, the water runs off instead of soaking in. Moisture is also lost by evaporation. A very striking instance of this came under my notice recently. One settler, despite advice to the contrary, harrowed his fallow after ploughing and the land, being a heavy clay, set down "like a road." The consequences are obvious.

From the point of view of sucker control, there is no doubt about the value of a cross-ploughing, even when the first ploughing was done thoroughly. This is not only the experience of many farmers in the "mallee" but is also confirmed at the Salmon Gums Experiment Farm. In cultivating the "new-burn" fallow, portion was cross-ploughed in the spring and the balance worked with a springtyne cultivator. The Manager (Mr. L. G. Seinor) informs me that when the suckers were cut prior to seeding, an average day's work on the cross-ploughed section was between three to four times greater than on that which was springtyne culitvated. It is realised, of course, that cross-ploughing is a more expensive operation than a springtyne cultivation, but knowing the value of the former, farmers should strive to do this, where necessary, and it will pay in the long run.

Probably one of the worst defects in the fallows was that they were too flat, *i.e.*, the surface was too fine and level, and the mulch had a tendency to run together. The soils of the "mallee" do not remain cloddy and crumbly, as they do in other portions of the wheat belt, but have a marked tendency to "fine up." Therefore a springtyne cultivator or a scarifier should be used in preference to harrows. Harrows will kill weeds only in the very early stages of their growth. One competitor used these for weed destruction after rain in summer, but as the land was a heavy clay, this operation did more harm than good, and he had the greatest difficulty getting the land back into condition prior to seeding.

Fallow competitions can do a great deal towards improving the standard of fallow in a district. Therefore it is hoped that the farmers in this area will take a more active part in the competition this year. Those competitors who did participate in the competition under review are to be congratulated on their keenness which made the competition possible.

An aspect which should be borne in mind in the future is that competitors should not concentrate their efforts on a particular fifty acre piece and allow the standard of the balance of their fallow to suffer in consequence. This would defeat one of the primary objects of the competition, that of improving the general standard of the district's fallow, and would take away the commercial value as well, quite apart from holding the competitor up to ridicule.

FIFTY ACRE FALLOW COMPETITION, 1929-30.

MT. MARSHALL AGRICULTURAL SOCIETY.

Judge—G. L. THROSSELL, Agricultural Adviser.

There were fourteen competitors in the fallow competition conducted by the Mt. Marshall Agricultural Society this year, the competition being judged in February.

The rainfall from June to February is shown in the table hereunder:—

	Fallowing Rains.				Spring Rains.			Summer Rains.					Total Rain on Fallow.
	June.	July.	Aug.	Total.	Sept.	Oct.	Total.	Nov.	Dec.	Jan.	Feb.	Total.	
Bencubbin ...	182	86	100	368	16	25	41	131	2	...	21	154	563
Gabbin, North	216	110	106	432	22	76	98	78	...	...	...	78	608

The points awarded are shown in the following table:—

MT. MARSHALL AGRICULTURAL SOCIETY.

FALLOW COMPETITION, 1929-1930.

Judge—G. L. Throssell, Dip. Agric., Agricultural Adviser.

Competitor.	Address.	Moisture.	Mulch.	Absence of Weeds.	Consolidation.	Uniformity of Preparation.	Total.
		40 pts.	10 pts.	10 pts.	20 pts.	20 pts.	100 pts.
1.—Thompson, M. A.	N. Bencubbin	34	9	9	19	19	90
2.—Breakell & Son ...	Bencubbin ...	35	8	9	19	18	89
3.—Gobbart; W., & Son	Gabbin ...	35	8	8	19	18	88
4.—Brindle, R. ...	do. ...	34	8	9	18	19	88
5.—Collins, M. C. ...	Bencubbin ...	36	8	8	17	18	87
6.—Oaten, W. R. B.	Gabbin ...	34	8	8	18	19	87
7.—Clare, P. ...	do. ...	33	8	9	19	18	87
8.—Langley Bros. ...	N. Bencubbin	33	9	8	18	18	86
9.—McManus Bros. ...	do. ...	32	8	9	19	18	86
10.—Flitcroft, H. ...	Gabbin ...	33	8	8	18	17	84
11.—Lawrence, S. T....	do. ...	32	7	9	19	17	84
12.—Breakell, R. T. ...	N. Bencubbin	32	8	6	18	17	81
13.—Veal, S.	Gabbin	33	7	7	17	17	81
14.—Burn G. H. ...	do.	32	8	7	17	17	81

Mr. M. A. Thompson, of North Bencubbin, a new competitor, won the competition with an entry which scored 90 points. This fallow was ploughed in June with a disc implement to a depth of four inches, and was cultivated to the full depth of ploughing with a springtyne cultivator at the end of July and early August. The next cultivation was with the same implement after rain in November. This operation was not quite as deep, and produced a good seed bed under a mulch about 2½ inches deep.

H. Breakell & Son, also new competitors, were awarded 89 points for their entry.

The following table summarises the cultural details of competitors. Information was not available from two entries.

Competitor.	Original Timber.	Years Cropped.	Rotation.	When Fallowed.	Type of Plough.	Depth of Ploughing.	Cultivations.	Points Awarded
						inches.		
1.—M. A. Thompson	Salmon gum, gimlet and morrell	...	...	June ...	Disc ...	4	Springtyne cultivated July–August and early November	90
2.—H. Breakell & Son	Salmon gum, gimlet, morrell and tea-tree	Since 1912	3	July ...	Mouldboard	3 to 4	Skimmed with sundercut in August. Springtyne cultivated in November	89
3.—W. Gobbart & Son	Gimlet, mallee and tea-tree	Since 1923	2	June ...	Sundercut ...	4	Springtyne cultivated July, August, and November	88
4.—R. Brindle ...	Morrell, salmon gum, gimlet and tea-tree	4	3	June–July ...	Mouldboard	3½	Springtyne cultivated July, October, and January	87
5.—M. C. Collins ...	Salmon gum and gimlet	...	3	Early June	Mouldboard	4	Disc harrowed in September	87
6.—W. R. B. Oaten	Salmon gum, gimlet and tea-tree	Since 1922	2	End June ...	Sundercut ...	3 to 4	Crossed with sundercut in August. Harrowed in February	87
7.—P. Clare ...	Gimlet and mallee ...	Since 1916	2	July ...	Mouldboard...	3	Crossed with sundercut in September. Springtyne cultivated November	87
8.—Langley Bros. ...	Salmon gum, gimlet, mallee and tea-tree	4	2	July ...	Disc ...	3 to 4	Cultivated with combine drill in August	86
9.—H. Flitcroft ...	Salmon gum, gimlet and tea-tree	...	2	June ...	Disc ...	3 to 4	Crossed with sundercut early September. Springtyne cultivated October and portion November	84
10.—R. T. Breakell ...	Salmon gum and gimlet	Since 1910	2	July ...	Disc ...	4	Cross sundercut August. Springtyne cultivated September and November	81
11.—S. Veal	Salmon gum, gimlet and morrell	Since 1923	2	June ...	Disc ...	3	Springtyne cultivated August, September, and October	81
12.—H. G. Burn ...	Salmon gum, gimlet and morrell	Since 1914	2	July ...	Sundercut ...	3	Springtyne cultivated September. Portion in November	81

A rather interesting example of the advantages of a springtyne cultivator was observed when judging. Portion of one entry had been worked, after rain, with a heavy disc implement and another portion with a springtyne cultivator. It was found that the moisture content in the tyne cultivated portion was greater. The condition of the mulch was also better.

The weed commonly called Summer Thistle, Californian Thistle, or Potato Weed (*Solanum hoplopetalun*) is becoming too prevalent. A few of the competing areas were rather badly infested. It is quite erroneous that this weed is only unsightly and is not a robber of moisture. It is an undesirable weed to have growing on the farm, and can be checked with less difficulty by cultivation in the early stages of its growth. Sheep have been observed to eat the berries, but it is reported that this is a means of spreading the seeds all over the farm.

FIFTY ACRE FALLOW COMPETITION, 1929-30.

MERREDIN AGRICULTURAL SOCIETY.

Judge—G. L. THROSSELL, Agricultural Adviser.

Twelve entries were submitted for judging in the fallow competition this year, and although there was a falling off of eleven compared with the previous year, when twenty-three entries were received, it is pleasing to note that six competitors entered the competition for the first time, and in fact the first three places were filled by them. The newer districts are apparently alive to the value of a fallow competition, and they are better represented than the older settled areas.

The rainfall from June to February is shown in the following table:—

Place.	Fallowing Rains.				Spring Rains.			Summer Rains.					Total Rain on Fallow.
	June.	July.	Aug.	Total.	Sept.	Oct.	Total.	Nov.	Dec.	Jan.	Feb.	Total.	
Merredin ...	389	137	128	654	21	52	73	233	1	...	1	235	962
S. Walgoolan	242	109	86	437	14	39	53	428	5	...	...	433	923
Nukarni ...	270	103	77	450	15	64	79	205	...	...	...	205	734

Although good rains fell early in the fallowing period they were not maintained, and difficulty was experienced in finishing ploughing on account of the hardness of the ground. The first six fallows, however, were ploughed in June, which has proved to be the best month for fallowing. The spring was exceptionally dry, but heavy rains were recorded during the first week in November. Half of the competitors availed themselves of this opportunity to give the fallows a further cultivation.

The awards are set out in the following table:—

MERREDIN AGRICULTURAL SOCIETY.

FALLOW COMPETITION, 1929-1930.

AWARDS.

Competitor.	District.	Points.					
		Moisture.	Mulch.	Absence of Weeds.	Consolidation.	Uniformity of Preparation.	Total.
		40 pts.	10 pts.	10 pts.	20 points.	20 points.	100 pts.
J. B. Lambert ...	South Burracoppin	35	8	9	19	19	90
H. C. Emmett ...	North Merredin	35	9	8	19	18	89
King Bros. ...	Walgoolan ...	34	9	8	19	18	88
J. D. Maughan ...	do. ...	34	8	8	19	19	88
M. Murphy ...	do. ...	34	8	9	18	18	87
J. H. Smallacombe	Nangeenan ...	34	8	8	19	18	87
R. M. King ...	Walgoolan ...	32	9	8	19	19	87
T. J. & C. Maughan	Nukarni	33	8	7	18	19	85
Sheard & Shaw ...	North Burracoppin	33	8	7	18	19	85
W. H. Cockram ...	Nukarni	33	7	8	18	17	83
W. Cook	South Burracoppin	32	8	6	18	19	83
J. E. Clothier ...	Totadgin ...	32	7	7	19	17	82

The competition, which was judged in February under a similar scale of points as in the previous year, was won by Mr. J. B. Lambert, of South Burracoppin, with an entry which scored 90 points. Mr. H. C. Emmett, of North Merredin, with a total of 89 points, was placed second. Both these competitors have not previously entered a fallow competition, and are to be congratulated on their success in their initial attempt.

The details of the cultural methods of the competitors are shown in the following table:—

Competitor.	Original Timber.	Years Cropped.	Rotation.	When Fallowed.	Type of Plough.	Depth of Ploughing.	Cultivations.	Points Awarded.
		years.	years.			inches.		
1.—J. B. Lambert	Salmon gum and gimlet	4	2	June ...	Scarifier ...	3	Sacrified in July and November; harrowed in November	90
2.—H. Emmett ...	do. do. ...	...	2	June ...	Sundercut ...	4 to 6	Turned back with sundercut August; harrowed in September and October; cultivated with springtyne in November	89
3.—King Bros. ...	do. do. ...	3	2	June ...	Sundercut ...	3 to 4	Scarified in September; cultivated with a springtyne in November	88
4.—J. D. Maughan	Gimlet and ti-tree ...	5	2	June ...	Disc ...	3 to 4	Scarified in July and August; springtyne cultivated twice in September, in October, and harrowed in November	88
5.—M. Murphy ...	Gimlet and morrell ...	4	2	June ...	Disc ...	3 to 4	Scarified in July; springtyne cultivated in October	87
6.—J. H. Smallacombe	Salmon gum and gimlet	...	2	July-August	Mouldboard	4	Cross-ploughed with disc September; springtyne cultivated November	87
7.—R. M. King ...	do. do. ...	4	2	July ...	Disc ...	3 to 4	Reploughed in August; cultivated with combine drill November	87
8.—T. J. & C. Maughan	do. do. ...	(No details sent		in — absent	when judged)			
9.—Sheard & Shaw...	Gimlet	7	2	July ...	Scarifier ...	3 to 4	Scarified in September and November	85
10.—W. Cook ...	Salmon gum, gimlet and morrell	9	3	July ...	Disc ...	4	Cultivated with a sundercut in August and September	85
11.—J. E. Clothier ...	Salmon gum and gimlet	...	2	August ...	Portions with combine, mouldboard, and disc	3 to 4	Cultivated with combine drill in October and November	82

From this table it will be seen that at present almost all the competitors are employing a two-year rotation—fallow, wheat. This rotation

is a very exhaustive one on the soil, and in time will cause a variety of troubles, for instance depletion of the humus or organic matter, which results in deterioration of the physical condition and decline of fertility. But what is perhaps the most immediate result of a two-year rotation is the increase of such diseases as "Takeall" and Flagsmut. When fencing, water supplies, and reserves of feed have been obtained, farmers will be able to change to a three-year rotation—fallow, wheat, pasture.

The winning fallow was not ploughed, but scarified in June. This may seem to some to be a departure from the usual requirements of fallowing. However, it is not the type of implement which is so important, but that whatever implement is used, it is suited for the work and is doing the work thoroughly. In this case the scarifier was satisfactory, but it would not be advisable, on the result of this, to recommend a scarifier for fallowing on all classes of soil or for all soils of the same class as this.

Experiments at the Merredin Experiment Farm show that for Salmon Gum and Gimlet soils it is unnecessary to plough deeper than four inches, providing the work is done uniformly. However, ploughing deeper does not decrease the yields, if a proper seedbed has been prepared, but it requires more power, and hence four-inch ploughing is the most economical.

A REVIEW.

ELEMENTARY PRACTICAL AGRICULTURAL CHEMISTRY.

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This small book is written for students of Agricultural Chemistry, and sets out a series of simple exercises in chemical manipulation. This is to enable the student to understand fully the underlying principles of analytical chemistry, provided he has had some previous training in elementary theoretical chemistry.

The book is particularly concise, and has a moderately wide range, due mainly to the manner in which it is written.

Beginning with a Qualitative Analysis section, it gives a well set out summary of Preliminary "Dry-Way" Tests and of "Wet-Way" Tests, with the inferences to be drawn from each, and a series of confirmatory tests for each of the metals and acid radicals following. This portion of the book is useful not only to the student, but to the past student, who is liable at any time to have to perform a little qualitative analysis. The section dealing with the volumetric analysis is much more concise, and, in consequence, is not likely to be as useful for after references as the previous section on Qualitative Analysis.

The experiments on substances of agricultural interest include experiments on water, milk, butter, soils, manures, and pickling materials, and are followed by notes on the properties of the simpler and more common organic compounds.

On the whole, the book is set out in note form, and is very easy to refer to for simple reactions and experiments. It gives a general and well set-out course for the teacher of elementary practical agricultural chemistry. This course has two good features, the first being that it can without difficulty be enlarged upon, and provides a good skeleton on which to build up a much more advanced course in Agricultural Chemistry, and the second, that it deals with subjects which are essentially Australian.

The book should prove to be of use in this State to both teachers and students, wherever agricultural chemistry is taught as a subject distinct from pure chemistry.

The book is published in Australia by Robertson & Mullens, Limited, of Melbourne, and may be obtained through the local booksellers; retail price, 6s.

MURESK AGRICULTURAL COLLEGE.

CHICKEN-FEEDING EXPERIMENT CARRIED OUT BY J. H. RICHES, B.Sc. (Agric.), AND S. FROOME.

Introduction.

The importance of supplying a ration adequate in regard to minerals as well as to what are usually regarded as food nutrients has become increasingly evident in recent years with the developments of high producing, early maturing breeds. This had led to investigations into the relative importance of the various mineral substances required, the amount occurring in the ordinary foodstuffs, and the best means of making up any deficiency.

Experiment has shown that an element which is very frequently deficient is phosphorus, and it is possible to make good this deficiency by the addition of calcium phosphate to the diet in the form of sterile bone meal.

Bone meal is always incorporated as a standard part of the mash fed to growing chickens, and it occurred to the authors to test whether this bone meal might not be replaceable by a mineral phosphate which would be cheaper and more easily obtainable.

Accordingly an experiment was planned to test this theory.

Method of Investigation.

Ground Nauru rock phosphate being the most readily obtainable mineral phosphate, it was decided to test it against the bone meal; later, on the suggestion of the Director of Agriculture, basic superphosphate was also included in the test.

The experiment was commenced as soon as the chickens were old enough to be removed from the brooder house to the chicken pens. The lots were made up of 18 chickens, 16 White Leghorn and two Black Orpington in each, no attempt being made to select for sex.

As it was impossible owing to the lack of facilities to put a distinguishing mark on each bird, it was decided to take the aggregate weight of each lot. These weights were to be taken at fortnightly intervals.

The chickens received the mash at the morning and mid-day feeds, and received whole wheat grain at night. They had a plentiful supply of fresh water, and were also supplied with shell grit *ad lib*.

The mash, which was similar to that fed to all the chickens on the farm, was made up by volumes, the amounts not being weighed exactly; as, however, the density of the ingredients did not vary to any great extent, it can be assumed that the composition was fairly constant, and was in the proportions of—

Greenstuffs	1¼ lbs.
Pollard	1¾ lbs.
Bran	¾ lb.
Water	1⅞ lbs.

These were the weights of feed, mixed on 31st October, for the day's mash for two pens. This mash was halved, and 2 ozs. of bone meal were added to one half, while 1½ ozs. of ground rock phosphate were added to the other half, these amounts containing equal quantities of P_2O_5. Later, when the basic superphosphate was being tested, the total amount of mash was doubled, and two quarters received 2 ozs. of bone meal each, one quarter 1½ ozs. rock phosphate, and one quarter 3½ ozs. basic superphosphate.

Results.

The experiment was commenced on 26th September with chickens selected from two broods hatched on August 16 and 23 respectively. The chickens were healthy and strong, and were as even in size as could be obtained. They were weighed when first put in the pens, and then at fortnightly intervals, except for the first period, when a month elapsed between weighings, and the last period, which was extended to three weeks.

The weights at the different periods are given in Table 1:—

TABLE 1.

Lot.	26-9-29		24-10-29		7-11-29		22-11-29		5-12-29		27-12-29	
	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
1	12	14	22	6	26	6	31	7	41	0	49	7
2	13	0	21	3	25	6	30	12	40	2	47	7
3	...		...		27	6	30	14	41	5	48	14
4	...		...		26	7	30	9	40	8	48	7

Note:—

Lot 1 were those receiving bone meal.

Lot 2 those receiving phosphate.

Lots 3 and 4 were added when it was decided to include basic superphosphate in the test. They were chickens from the same broods, and had been receiving the ordinary mash, including bone meal, prior to their in-

clusion in the test. It was thought advisable to include a second pen on bone meal to compare with the basic superphosphate, so lot 3 were placed on the bone-meal mash, and lot 4 on the basic superphosphate.

The total amount of mash, including minerals, was increased by 50 per cent. in all lots on 22nd November, and this is reflected in the greatly increased gain at the following weighing, showing that, although the birds were receiving a plentiful supply of grain, the increase in the mash was needed.

Table 2 shows the increases in weight for each lot at the respective weighing periods, and Table 3 the total gains over the whole period of the experiment.

TABLE 2.

Lot.	24-10-29		7-11-29		22-11-29		5-12-29		27-12-29	
	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
1	9	8	4	0	5	1	9	9	8	7
2	8	3	4	3	5	6	9	6	7	5
3	...		...		3	8	10	7	7	9
4	...		...		4	2	9	15	7	15

TABLE 3.

Lot.	26-9-29 to 27-12-29.		Lot.	7-11-29 to 27-12-29.	
	lbs.	ozs.		lbs.	ozs.
1	36	9	3	18	0
2	34	7	4	17	14

An inspection of these figures reveals that over the first month of the test Lot 1 made a somewhat greater gain than Lot 2. At the next three weighings the gains of the two lots were approximately equal, while at the last weighing Lot 1 again made a somewhat greater gain.

The total difference in gains at the end of the test was a matter of 2 lbs. 2 ozs. in the lots, a difference of 1.9 ozs. per bird.

In regard to Lots 3 and 4, the gains at the three weighings vary alternately in favour of each lot, but the difference at the end is only 2 ozs. between the total weights.

As it was thought that the sex of the birds probably had some effect on the relative weights, it was decided to make some attempt to adjust the weights to allow for this effect.

Table 4 shows the composition of each lot in regard to sex:—

TABLE 4.

Lot.	Black Orpingtons.		White Leghorns.	
	Male.	Female.	Male.	Female.
1	2	0	3	13
2	1	1	9	7
3	1	1	9	7
4	0	2	7	9

In order to arrive at some formula by which to adjust the weights, 12 males and 12 females of each breed from the same broods of chickens were weighed at the end of the test, and the average differences between the sexes in weight per bird were found and used to correct the weights of the several pens.

Table 5 gives the average difference in weight between the sexes, and Table 6 the adjusted weights for the pens:—

TABLE 5.

Breed.	Cockerels.		Pullets.		Difference.	
	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Black Orpington ...	3	10·8	2	8·4	1	2·4
White Leghorn ...	3	1·4	2	7·2	0	10·2

TABLE 6.

Lot.	Real weights at 26-9-29		Real weights at 27-12-29		Weights adjusted by Table 5.		Gains on adjusted weights.	
	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
1	12	14	49	7	45	3·6	32	5·6
2	13	0	47	7	40	8·8	27	8·8

An inspection of this table reveals that the difference in gains between the two pens is increased slightly in favour of Lot 1, the difference now being 4 lbs. 12.8 ozs., or 4.27 ozs. per bird; again only a small difference.

It was not considered practicable to adjust the weights of Lots 3 and 4, as no allowance could be made for the almost certain difference between the sexes when their test commenced.

It remains to be stated that the birds in all lots appeared to be perfectly healthy, and showed no disparity to the eye between different groups.

Conclusion.

It is realised that the above experiment is by no means conclusive. Further experiments are therefore contemplated to eliminate doubtful points and to provide more definite information.

It is thought reasonable, however, to assume that if the addition of phosphates to the ration is taken to be necessary, ground rock phosphate of high grade or basic superphosphate will give almost, if not quite, as good results as sterile bone meal, at a greatly reduced cost.

BRAXY-LIKE DISEASE OF SHEEP IN WESTERN AUSTRALIA.

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The term "Braxy-like" was applied by Professor Dakin to a disease which apparently originated in the Great Southern District of this State about 1915. The disease was so named because of its similarity to Braxy, a disease affecting sheep in Europe.

It is now known that, apart from the occasional occurrence of an apparently identical disease in South Australia and New Zealand, the disease is peculiar to this State and quite distinct from Braxy, and from the Black Disease (Braxy-like) of the Eastern States.

The distribution of the disease in this State is a wide one. It is known from Kojonup and Gnowangerup in the South to Dowerin and Coorow in the North, and almost as far as Merredin in an Easterly direction.

The incidence of the disease varies greatly—different districts being affected in different years. The disease is definitely a seasonal one, mortality commencing with the advent of green feed, usually about May or June, and carrying on intermittently until October or November. (A condition which is probably identical with the one described does occasionally occur in sheep depastured on peas in the summer months—particularly after rain.)

Mortality is usually associated with improvement of pastures, and does not occur on uncultivated country. The apparent illness is of short duration, affected animals being usually found dead without evidence of a struggle. Carcases putrefy rapidly. The sheep which are attacked are almost invariably in good condition, and are usually the "best" in the flock. All breeds and both sexes are affected. The age of incidence is from about three months to full-mouth—occasionally older animals are affected. Young sheep are probably most susceptible. The percentage of deaths experienced in a flock may even reach 30 per cent.; individual losses of five per cent. for the season are quite common.

SYMPTOMS.

As previously mentioned the period between the onset of symptoms and death is very short, and usually the sheep are simply found dead.

The initial symptoms are a staggering gait with frequently "knuckling over." The affected animal appears excited, and often chews dirt, sticks, etc. Within half-an-hour or so the animal lies down, usually on its side with the head turned round on the flank. At this stage the sheep makes convulsive movements from time to time, especially if excited, and may actually get up and move to a fresh place. The breathing is usually rapid and shallow. Frothing at the mouth and grinding of teeth are common symptoms. Very soon the animal becomes unconscious, lies stretched out on its side, and dies quietly. Death usually occurs three or four hours after symptoms are first noticed—some animals show practically no symptoms, a few, on the other hand, may linger up to 24 hours. Some cases, particularly lambs, show a "nervous" form, the notable symptoms being convulsions and "galloping" movements. Most affected sheep show signs of scouring, and scoured droppings on sheep camps are often said to herald the approach of the trouble. Occasional cases have been known to recover, but a fatal termination is the general rule.

POST MORTEM FINDINGS.

Carcases of sheep which have just died show only slight departures from normal. There are more or less constant changes, but these are easily passed over by the untrained eye.

The paunch is usually fairly full, and the contents frequently show signs of excessive fermentation. The bowels are usually "inflamed" (congested) to a slight degree, and in a patchy sort of fashion. The gall bladder is usually distended with bile. The liver is somewhat softer than normal. The kidneys when cut across appear slightly congested. There are frequently small blood spots (petechiae) on the outside of the heart and large haemorrhages on the inner lining. Microscopically, there is evidence of degeneration in certain organs. The changes are those of a toxaemia, *i.e.*, there is a poison circulating in the blood and producing changes in many of the organs (kidneys, liver, heart, etc.).

CAUSE.

As a result of careful investigation it has been shown definitely that the cause of the disease is the very active growth of a soil germ (*Bacillus welchii*) in the contents of the small bowels of affected animals. The actively growing germ produces a toxin, or poison, which is absorbed from the bowel. In most instances death is due to the action of this toxin on the heart—resulting in heart failure. The toxin also acts on the brain and nervous system.

We have been able, with *B. welchii* or its toxin, to reproduce a disease in experimental sheep which appears identical with the natural one.

B. welchii is one of the most widely distributed soil organisms known, and is found in small numbers in the bowels of man and animals where it normally does no harm. If conditions arise which favour its growth in the small bowel (as sometimes happens in man), disease results.

In sheep affected with Braxy-like disease, we have estimated that there are as many as 10,000 million *B. welchii* in the contents of the small bowel. Using the same method we have been unable to detect the presence of any of these germs in the small bowel contents of healthy sheep from the same area. The small bowel contents from affected sheep have been shown to be very highly toxic because of the presence of *B. welchii* toxin (produced by the actively growing germs).

What factors are favouring the growth and production of *B. welchii* in the small bowel of affected sheep? We do not yet fully appreciate these "predisposing factors," but it appears that certain types of pasture eaten by sheep favour the growth of this germ in the bowel contents. The condition of the animal would also appear to be important; and the soil type appears to have some bearing on the appearance of the disease.

All these phases are being investigated experimentally in the field, and particularly at the Avondale State Farm where we are attempting to correlate chemical analyses of pastures and soil with the incidence of the disease.

METHODS OF CONTROL.

1. *Roughage.*—Turning sheep into bush country invariably prevents further losses (after the first few days), but is not very practicable in most instances. Very few sheep farmers are able to provide natural roughage for their sheep, so one has to resort to artificial measures.

As it appears that too "rich" a feed favours the disease, it is reasonable to recommend farmers to feed artificial roughage (hay, chaff, straw) to flocks in which mortality is occurring in order to balance the ration, and thereby control the disease. We hope to obtain some experimental evidence on this point.

2. *Management.*—Shifting sheep to different paddocks every few days frequently checks losses.

It appears that the ingestion of contaminated soil on, or with pasture, is an important factor in the production of the disease. Therefore, as far as possible, sheep should be managed so as to prevent their eating too close to the ground and thus picking up soil and with it numbers of the casual organism, *B. welchii.*

Compulsory daily exercise is recommended by some sheep owners who have experienced the trouble. Yarding of sheep or putting them into bare paddocks every night appears to prevent mortality, but is not practicable in most instances. Carcases should always be burnt, as they act as breeding grounds for *B. welchii,* and result in heavy contamination of the soil with the germ.

3. *Vaccine.*—Up to the present, preventive inoculation appears the most hopeful method of control, and the writer is attempting to perfect a vaccine for this purpose. A vaccine, produced in the laboratory, was tested in the field last year, and suggestive results were obtained.

Further tests are being carried out this season with an improved product, and it is hoped that this inoculation will prove an effective preventive measure.

Note.—Recent work has shown that the organism causing this disease, though very closely related to *B. welchii,* does not appear to be absolutely identical with it.

THE COST OF FEEDING PURE BRED COWS UNDER THE AUSTRALIAN OFFICIAL HERD RECORDING SCHEME.

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During the past year records showing the details of rations fed to all cows under test have been carefully kept, and the cost of feeding for all cows in the Herd Recording Scheme is submitted.

During the year 16 pure bred herds have been tested, made up as follows:—Jersey, 6; Milking Shorthorn, 5; Guernsey, 4; Red Poll, 1.

Table 1 contains the data for the current year, which shows that production, cost of feeding and nett profit per cow from the sale of butter fat are remarkably close to the figures for 1929, the results from all years since 1924 being compared in Table 6.

A careful study of Table 1 brings out the fact that two main factors are concerned in the economical production of dairy produce:—1, Production of the cow. 2, Cost of Feeding.

1.—*Production of the Cow.*

It is obvious that the greater the production of the cow, the more economical will the production of butter fat or milk be; provided correct feeding methods are practised. Comparing herds A and O, it will be seen that the cost of feeding is equal, but that the average production of Herd A is double that of Herd O. One would, at first sight, expect the profit over cost of feeding in Herd A to be double that of Herd O, but this is not so, the profit being more than five times as great.

This is because the maintenance ration required for cows in each herd is approximately the same, and approximates to 46.5 per cent. of the ration, or a cost of £7 15s. 5d. before any return from the cow can be expected. In Herd O two cows are required to produce as much fat as one in Herd A, which is equivalent to an expenditure of £7 15s. 5d. $\times$ 2 = £15 10s. 10d. for maintenance in Herd O to produce the same amount of butter fat. It is for this reason that high producers, economically fed, produce dairy products relatively very cheaply to low producers.

COMPARISON OF HERD A. AND O.

——	Yield of Fat per Cow.	Cost of Feed per Cow.	Profit per Cow.
	lbs.	£ s. d.	£ s. d.
Herd A.	435·65	16 14 2	23 4 4
Herd O.	222·08	16 15 8	4 10 9
Difference ...	213·57	0 1 6	18 13 7

2.—*Cost of Feeding.*

The capacity of high production in dairy cows is one that calls for continued effort and skill on the part of the breeder of milch cattle to maintain and improve, and provided feeding is carried out adequately, is not immediately under the control of the dairy farmer.

The capacity for high yield inherent in cows may, however, be nullified by expensive systems of feeding being practised by the owner, as a comparison of Herds C and J makes apparent.

COMPARISON HERDS C. AND J.

——	Average Fat per Cow.	Cost of Feeding per Cow.	Profit per Cow.
	lbs.	£ s. d.	£ s. d.
Herd "C."	382·85	27 7 10	7 10 4
Herd "J."	257·83	9 5 8	14 1 8
Difference ...	— 125·02	— 18 2 2	+ 6 11 4

Herd C with a production of 125 lbs. of butter fat more than Herd J, returned £6 11s. 4d. less profit, solely due to expensive methods of feeding. The owner of Herd J grows nearly all the cows require on the farm, while the owner of Herd C purchased practically all feeds, including roughages. A further comparison of two herds, with a similar production, also brings out the importance of carefully scruitinising the costs of feeding dairy cattle.

COMPARISON OF HERDS L AND M.

——	Butter Fat per Cow.	Cost of Feed per Cow.	Profit per Cow.
	lbs.	£ s. d.	£ s. d.
Herd L.	252	10 18 8	11 18 6
Herd M.	252	17 4 10	5 3 9
Difference ...	...	— 6 6 2	+ 6 14 9

The above comparison shows that with herds of any medium producing capacity good profits are possible where the cost of feeding is studied.

A comparison of the three main breeds under test will be of interest, though the writers do not intend this comparison to be regarded controversially.

——	Average Yield of Butter Fat.	Average Cost of Feed.	Average Profit as Fat over Cost of Feed.	Average Profit as Milk over Cost of Feed.
	lbs.	£ s. d.	£ s. d.	£ s. d.
Guernsey (4 herds) ...	302·00	15 3 6	12 6 10	15 17 10
Milking Shorthorn (5 herds)	298·40	16 18 5	11 8 2	22 7 10
Jersey (6 herds)	301·17	14 6 7	13 1 1	16 6 4

The results show that the average yields of herds from the three breeds are remarkably even, and, as might be expected, the larger breeds costing more to feed on the average; the Jersey leading for the production of butter fat, closely followed by the Guernsey and Milking Shorthorn. For the production of milk, however, the Milking Shorthorn leads easily, as might be expected.

Table 6 shows the results of seven years recording, and may be taken, therefore, as a reasonably true average, as all cows have been included when working out returns for any one year, irrespective of ages, production or failure to reach the standards laid down by the rules of the Pure Bred Recording Scheme.

The following is a digest of Table 6, giving the main items for years 1924-1930:—

Average Yield per Cow. Milk.	Average Yield per Cow. Butter Fat.	Average Value of Skim Milk.	Average Cost of Feed per Cow for period.	Average Profit per Cow at average Price of Butter Fat.	Average Profit where Milk sold at 1s. 3d. gallon.	Average Cost of Feed to produce 1lb. Butter Fat.	Average Cost to produce 1 gallon of Milk.
gals.	lbs.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	pence.	pence.
619	300·21	3 3 3	14 3 8	12 19 1½	17 6 2	11·42	5·54

In order to facilitate the study of the results, the following extracted information is supplied:—

Table 1.—Herds in order of merit as Butter Fat Producers and Costs of Production.
Table 2.—Average Results for Year 1930.
Table 3.—Herds in order of merit as Producers of Milk.
Table 4.—Herds arranged to show Cost of Feed per 100 lbs. of Fat.
Table 5.—Herds arranged to show Cost of Feed per 1 gallon of Milk.
Table 6.—Average costs for 7 years, 1924-1930.

TABLE I.—HERDS IN ORDER OF MERIT AS PRODUCERS OF BUTTER FAT.

Columns	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Herd.	Average Fat per Cow for period of 9 months.	Average Skim Milk per Cow for period.	Value of Fat at 1/7½ per lb. (average price).	Value of Skim Milk for period at 2d. per gallon.	Average Value of Fat and Skim Milk for period.	Cost of Feed per Cow for the period.	Profit per Cow for period by Sale of Fat.	Value of whole Milk at 1/3 per gallon after allowing for rearing Calf.	Profit per Cow by Sale of Fresh Milk at 1/3 per gallon.	Cost of Feed for 100lbs. of Fat.	Cost of Feed per 1 gallon of Milk.
	lbs.	gall.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d	£ s. d	£ s. d.	pence.
A. W. Padbury ... A	435·65	543	35 8 0	4 10 6	39 18 6	16 14 2	23 4 4	44 4 0	27 9 10	3 16 19	4·20
W. G. Burges ... B	418·82	679	34 0 7	5 13 2	39 13 9	16 6 0	23 7 9	52 11 0	36 5 0	3 17 11	4·10
Mrs. Burnside C	382·85	456	31 2 2	3 16 0	34 18 2	27 7 10	7 10 4	38 7 1	10 19 3	7 3 1	9·34
E. McManus ... ... D	350·48	573	28 9 6	4 15 6	33 5 0	17 3 9	16 1 3	45 5 0	27 18 9	4 18 1	4·93
G. F. Coombes ... E	338·57	423	27 10 2	3 10 6	31 0 8	9 0 1	22 0 7	35 13 6	26 13 5	2 12 5	3·23
P. Rose ... ... F	300·40	388	24 8 11	3 3 6	27 11 7	10 2 5	17 9 2	32 1 4	14 11 2	3 7 5	3·90
C. Ironmonger... ... G	274·71	322	22 6 5	2 13 8	25 0 1	12 17 9	12 2 4	28 11 0	15 13 3	4 3 10	5·54
Wooroloo ... ... H	267·66	430	21 14 11	3 11 8	25 6 7	16 12 8	8 13 11	35 1 4	18 18 8	6 4 3	5·88
Muresk I	264·48	307	21 9 9	2 11 2	24 0 11	17 3 4	6 17 7	27 9 0	10 5 8	6 9 10	7·62
R. H. Rose ... ... J	257·83	290	20 19 0	2 8 4	23 7 4	9 5 8	14 1 8	26 6 4	17 0 8	3 12 0	4·27
A. W. Wilson ... K	255·34	299	20 14 11	2 9 10	23 4 9	15 17 10	7 6 11	26 15 10	10 18 0	6 4 6	7·17
Johnson & Giblett ... L	252·23	284	20 9 10	2 7 4	22 17 2	10 18 8	11 18 6	25 16 7	14 17 1	4 6 8	5·10
W. Padbury ... ... M	252·19	233	20 9 9	1 18 10	22 8 7	17 4 10	5 3 9	22 18 5	15 13 7	6 16 9	9·02
Hospital for Insane ... N	233·07	376	18 18 9	3 2 8	22 1 5	17 13 11	4 7 6	31 3 0	13 9 1	7 11 10	6·87
H. T. Dunkley ... O	222·08	393	18 0 11	3 5 6	21 6 5	16 15 8	4 10 9	32 11 0	15 5 3	7 11 2	6·33
H. G. Walton ... P	213·29	291	17 6 7	2 8 6	19 15 1	11 19 10	7 15 3	24 15 4	12 15 6	5 12 5	5·50
Averages ...	294·98	369	23 19 6	3 5 4	27 4 10	14 10 3	12 0 10	30 3 3	15 13 0	5 6 2	5·10

Oaten or wheaten chaff, £5 ton; Bran, £8 10s. 0d. ton; Pollard, £8 10s. 0d. ton; Crushed Oats, 3/- bushel; Linseed Meal, £13 10s. 0d. ton; Lucerne pasture, 3/- week; Lucerne Hay, £7 ton; Green Maize, 7/- ton; Silage, 7/- ton; Brewers' Grains, 6d. bush; Pasture, 1/6 week; Sudan Grass Pasture, 3/- week or 7/- per ton; Subterranean Clover pasture, 3/- week; Green Lucerne, £2 ton; Barley, green, 7/- ton or 3/- week as pasture; Clover Hay, £3 10s. 0d. per ton.

TABLE 2.—AVERAGES OF ALL COWS RECORDED, 1930.

1. 637 gallons of milk and 294.98 lbs. of butter fat.
2. 369 gallons of skim milk per cow.
3. Value of butter fat, at 1s. 7½d. per lb.—£23 19s. 4d.
4. Value of skim milk available for pig feeding—£3 5s. 6d.
5. Total credits to cow by sale of fat and skim milk—£27 4s. 10d.
6. Cost of feed for period—£14 10s. 3d.
7. Profit by sale of butter fat after deducting feed costs—£12 14s. 7d.
8. Value of whole milk at 1s. 3d. per gallon—£30 3s. 3d.
9. Profit by sale of fresh milk at 1s. 3d. per gallon after deducting cost of feed—£15 13s.
10. Cost of feed per 100 lbs. butter fat produced—£5 6s. 2d.
11. Cost of feed per gallon of milk produced—5.10d.

TABLE III.—HERDS IN ORDER OF MERIT AS PRODUCERS OF MILK, 1930.

Herd.	Milk Average.	Butter Fat Average.	Cost of Feed per Cow.	Profit as Milk.	Profit as Fat and Skim Milk.	Cost to Produce 100 lbs. Fat.	Cost to Produce 1 gallon Milk.
	gall.	lbs.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	pence.
B	954	418·82	16 6 0	36 5 0	23 7 9	3 17 11	4·10
D	837	350·48	17 3 9	27 18 9	16 1 3	4 18 1	4·93
A	803	435·65	16 4 2	27 9 10	23 4 4	3 16 9	4·20
C	707	382·85	27 7 10	10 19 3	7 10 4	7 3 1	9·34
H	678	267·66	16 12 8	18 18 8	8 3 11	6 4 3	5·88
E	670	338·57	9 0 1	26 13 4	22 0 7	2 12 5	3·23
O	637	222·08	16 15 8	15 15 3	4 10 9	7 11 2	6·33
F	623	300·40	10 2 5	14 11 2	17 9 2	3 7 5	3·90
N	618	233·07	17 13 11	7 11 10	4 7 6	7 11 10	6·87
G	558	274·71	12 17 9	15 13 3	12 2 4	4 13 10	5·54
I	541	264·48	17 3 4	10 5 8	6 17 7	6 9 10	7·62
K	532	255·34	15 17 10	10 18 0	7 6 11	6 4 6	7·17
P	523	213·29	11 19 10	12 15 6	7 15 3	5 12 5	5·50
J	522	257·83	9 5 8	17 0 8	14 1 8	3 12 0	4·27
L	515	252·23	10 18 8	14 17 1	11 18 6	4 6 8	5·10
M	459	252·19	17 4 10	15 13 7	5 3 9	6 16 9	9·02
Averages ...	636	294·98	£15 4 0	£15 13 0	£12 14 7	£5 6 2	5·10

Table IV.—HERDS IN ORDER OF MERIT SHOWING COST OF FEED PER 100 lbs. OF FAT, 1930.

Herd.	Cost of Feed per 100 lbs Fat.	Under Average.	Over Average.
	£ s. d.	£ s. d.	£ s. d.
E	2 12 5	2 13 7	
F	3 7 5	1 18 9	
J	3 12 0	1 14 2	
A	3 16 9	1 9 5	
B	3 17 11	1 8 3	
L	4 6 8	0 19 6	
G	4 13 10	0 12 4	
D	4 18 1	0 8 1	
P	5 12 5	...	0 6 3
H	6 4 3	...	0 18 1
K	6 4 6	...	0 18 4
I	6 9 10	...	1 3 8
M	6 16 9	...	1 10 7
C	7 3 1	...	1 16 11
O	7 11 2	...	2 5 0
N	7 11 10	...	2 5 8

Average of all herds—£5 6s. 2d. per 100lbs. Fat.

Table V.—HERDS IN ORDER OF MERIT SHOWING COST OF FEED PER ONE GALLON OF MILK PRODUCED.

Herd.	Cost of Feed per 1 gallon of Milk.	Under Average.	Over Average.
	pence.	pence.	pence.
E	3·23	1·96	
F	3·90	1·29	
B	4·10	1·09	
A	4·20	0·99	
J	4·27	0·92	
D	4·93	0·26	
L	5·10	0·09	
P	5·50	...	0·31
G	5·54	...	0·35
H	5·88	...	0·69
O	6·33	...	1·14
N	6·87	...	1·68
K	7·17	...	1·98
I	7·62	...	2·43
M	9·02	...	3·83
C	9·34	...	4·15

Average of all herds—5·19d. per gallon.

TABLE VI.—HERD AVERAGES FOR SEVEN YEARS, 1924–1930.

Year.	Milk.	Average Fat per Cow for period of 9 months.	Average Skim Milk per Cow for period.	Value of Fat for period.	Value of Skim Milk for period at 2d. per gallon.	Average Value of Fat and Skim Milk for period.	Cost of Feed per Cow for period.	Net Profit per Cow for period through Sale of Fat.	Value of whole Milk at 1/3 per gallon allowing for rearing Calf.	Net Profit per Cow through Sale of Fresh Milk at 1/3 per gallon.	Average Cost to Produce 1lb. Fat.	Average Cost to produce 1 gall. Milk.
	gallons.	lbs.	lbs.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	pence.	pence.
1930 ...	636	294·98	369	23 19 6	3 5 4	27 4 10	14 10 3	12 14 7	30 3 3	15 13 0	12·74	5·10
1929 ...	629	295·10	386	At 1/8 per lb. 24 11 10	3 4 4	27 16 2	15 1 0	12 15 2	33 6 9	18 5 9	12·24	5·74
1928 ...	592	280·56	353	At 1/7½ per lb. 22 15 9	2 18 10	25 14 7	15 11 4	10 3 3	30 19 0	15 7 8	13·34	6·34
1927 ...	602	290·72	362	At 1/7 per lb. 23 0 4	3 0 4	26 0 8	14 10 5	12 6 8	31 10 6	17 0 1	12·00	5·79
1926 ...	624	312·01	393	At 1/7 per lb. 24 14 0	3 5 6	27 19 6	14 14 7	13 4 11	32 5 5	17 10 10	11·15	5·66
1925 ...	652	308·59	407	At 1/5½ per lb. 22 10 0	3 7 10	25 17 10	14 13 2	11 4 8	30 10 5	15 9 5	10·77	6·15
1924 ...	600	319·50	362	At 1/7½ per lb. 25 19 2	3 0 4	28 19 6	10 4 10	18 4 8	32 1 3	21 16 5	7·7	4·09
Average for 7 years ...	619	300·21	376	£23 18 2	£3 3 3	£27 1 10	£14 3 8	£12 19 1½	£31 10 11	£17 6 2	11·42	5·54

During the year several notable records have been made by pure bred cows under the Recording Scheme; two West Australian records for the Milking Shorthorn breed having been established, and what is believed to be an Australian record for a senior two-year old Guernsey cow.

Hope 3rd of the Hill, owned by Mr. W. G. Burges, Tipperary, York, in producing, at four years eight months of age, 13,423 lbs. of milk and 606 lbs. of butter fat in 273 days, e.cated a new State record for her breed.

Hope 3rd of the Hill, Vol. 8, 4 years 8 months, born January 6, 1925, owned by W. G. Burges, "Tipperary," York, W.A.

Production: 13,423 lbs. milk, 606 lbs. butter fat, in 273 days.
1st Prize Perth Royal, 1927.
1st " " 1928.
2nd " " 1929.
2nd Type and Utility, 1929.

1st Prize, Milking Competition: Perth Royal Show, 1929, producing 60½ lbs. milk in 24 hours.

2nd Prize, Butter Fat Competition, Perth Royal Show, 1929, producing 2.823 butter fat in 24 hours.

The following particulars regarding the lactation period are of interest:—

Date of Test.	Milk for day.	Butter Fat for day.	Milk for sub-period.	Butter Fat for subperiod.
	lbs.	lbs.	lbs.	lbs.
October 1, 1929	63	2·871	1,890	86·13
November 5, 1929 ...	63·5	2·604	1,905	88·12
December 3, 1929	58	2·404	1,740	72·12
January 7, 1930	53	2·301	1,590	69·03
February 4, 1930	51	2·292	1,530	68·76
March 4, 1930	45	2·085	1,350	62·55
April 1, 1930	39	1·735	1,170	52·05
May 7, 1930	37	1·753	1,110	52·59
June 4, 1930	34·5	1·656	1,138	54·65

Hope 3rd of the Hill commenced her lactation period on 18th September, 1929, the record being produced during a summer of unusual severity for this district.

This was only made possible through the use of silage, made from oats and peas, which was fed during the greater part of this cow's lactation. In creating this second record, no effort was made by Mr. Burges to depart from the ordinary breeding programme, Hope 3rd carrying a calf for seven months of her test, and has calved regularly each year, as follows:—October 4, 1927, bull; October 20, 1928, bull; September 15, 1929, heifer.

It is interesting to note that this cow completed two lactation records in 1929-1930, each of which was the highest in her class. As a senior three-year old, Hope 3rd produced 13,182 lbs. milk and 577.15 lbs. butter fat. An equally meritorious performance was recorded by Mr. A. W. Padbury's Guernsey cow, Koogan Bonnie Jean, 1,612, who created an Australian record for the breed by yielding 8,164 lbs. milk and 505.39 lbs. of butter fat in 273 days, at two years seven months.

This yield of butter fat exceeds the previous record by 19 lbs., recorded by Parson's Red Rose 20th of Wollongbar, owned by the Department of Agriculture, New South Wales.

In this instance, also, another lactation period has commenced 11 months after the previous calving date, which shows that Bonnie Jean was carrying a calf for seven months of the testing period.

Koogan Bonnie Jean is a daughter of Robin of Nundorah, winner for the third time in succession of the prize for the bull who has sired the greatest number of daughters to attain the standards set for butter fat by the Official Recording Scheme. This bull has eight daughters who have produced an average of 411.36 lbs. of butter fat each, a magnificent record, branding Robin of Nundorah as an outstanding sire of the Guernsey breed.

It is now the property of Mr. Nelson, Group 21, Jardee.

The following particulars regarding the lactation period are of interest:—

Date of Test.	Milk for day.	Butter Fat for day.	Milk for sub-period.	Fat for sub-period.
	lbs.	lbs.	lbs.	lbs.
November 18, 1928 ...	38	2·112	1,140	63·36
December 11, 1928 ...	35	2·020	1,050	60·60
January 15, 1929	30·5	1·829	915	54·87
Feburary 12, 1929 ...	29	1·838	870	55·14
March 21, 1929	26	1·473	780	44·19
April 16, 1929	25½	1·473	765	52·29
May 14, 1929	24·5	1·698	735	50·94
June 13, 1929	29	1·874	870	56·22
July 18, 1929	31·5	2·054	1,039	67·78

In producing this record, also, silage was extensively used during the summer months to supply succulence in the feed, the regularity of production during the summer months being an indication of its value as a milk producer.

HERD TESTING.

THE OFFICIAL AUSTRALIAN PURE BRED DAIRY CATTLE PRODUCTION TESTING SCHEME.

Conducted by Dairy Branch, Department of Agriculture, Year ended 30th June, 1930.

Name of Cow.	Owner.	Breed.	Herd Book No.	Age. Years.	Age. Mths.	Date of Calving.	No. of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Weight of Milk Last Day.	Sire.
MATURE COWS—STANDARD 350 LBS. BUTTER FAT.												
								lbs.	%	lbs.	lbs.	
Melba 42nd of Darbalara ...	W. G. Burges ...	M.S. ...	12134	7	4	23-12-28	273	12,419	4·54	563·89	41½	Limelight of Darbalara—1105
Virginia 20th of Darbalara ...	do.	do. ...	14858	5	11	18-8-29	273	11,098	4·41	489·70	19½	Expe.t of Darbalara
Royals Camelia of Wongara ...	do.	do. ...	14560	6	1	29-8-29	273	10,956	4·25	466·21	27	Royal of Arrawatta—555
Starbright's Duchess of Glen Iris	Mrs. Burnside ...	Jersey ...	14176	5	11	24-8-29	273	8,043	5·66	455·86	16	Sweetbread's Duke of Glen Iris —1918
Matilda 7th of Berry ...	W. G. Burges ...	M.S. ...	14074	5	5	16-6-29	273	9,970	4·58	451·30	18½	Rutland of Darbalara—575
Morden Lady II. of Koojan ...	A. W. Padbury ...	Guernsey...	918	6	4	13-12-28	273	7,326	5·54	406·18	22	Gay Lad's Golden Dawn of Guildford—162
Madame 34th of Darbalara ...	W. G. Burges ...	M.S. ...	14,032	5	8	14-10-28	273	8,169	4·90	401·10	18	Stockwell of Darbalara—1850
Topsy Rye of Grass Vale ...	C. H. Ironmonger	Jersey ...	15702	5	11	20-6-29	273	6,754	5·79	391·40	16½	Rye Duke of Glen Iris—1994
Lily of Grass Vale	Mrs. Burnside ...	do. ...	8947	8	1	14-10-28	273	7,762	4·84	376·31	16½	Noble Fondant of Garden Hill —2268
Bonnet 2nd of Berry ...	W. G. Burges ...	M.S. ...	13168	6	5	17-2-29	240	8,160	4·60	375·36	20	Newhaven of Darbalara—1174
Dinah 2nd of Wollongbar ...	Dept. of Agriculture	Guernsey...	832	7	7	2-9-29	273	7,563	4·78	361·75	16	Judge of Wollongbar—184
Minnamurra Holly	Muresk Agricultural College	do. ...	953	6	5	23-6-29	273	7,885	4·39	346·80	18½	Minnamurra's Favourite's Prince —294
Wollongbar Dessie 2nd ...	do. do.	do. ...	1121	5	2	4-6-29	273	6,639	5·16	342·91	13	Bellman of Wollongbar—334
Jean of Moorlands	P. Rose	Jersey ...	13531	5	11	21-5-29	273	6,999	4·85	340·07	8	Reveller of Melrose—1804
Pearl 3rd of Claremont ...	Hospital for Insane	M.S. ...	Vol. 8	8	8	2-8-29	273	9,519	3·54	337·78	23	Norval of Darbalara—498
Cowslip 6th of Darbalara ...	W. G. Burges ...	do. ...	13348	6	1	6-10-28	273	7,335	4·60	337·73	15	Windsor of Darbalara—1444
Boronia Rye of Grass Vale ...	L. H. Ironmonger	Jersey ...	17529	5	8	22-4-29	273	7,565	4·4	332·92	18½	Rye Duke of Glen Iris—1994
Velvet of Wollongbar ...	Dept. of Agriculture	Guernsey...	774	8	3	5-11-28	273	7,851	4·21	330·98	17	Faithful Fido of Wollongbar—31
Belle 4th of Claremont ...	Hospital for Insane	M.S. ...	Vol. 8	5	5	25-8-29	273	8,454	3·89	329·50	8	Telyarup Prince of Claremont—2352
Jane of Moorlands	P. Rose	Jersey ...	13530	6	9	13-3-29	273	6,427	4·85	312·25	12½	Reveller of Melrose—1804
Molly 4th of Claremont ...	Hospital for Insane	M.S. ...	Vol. 8	7	5	2-12-28	273	7,695	3·91	301·30	20	Morven York Rose 5th
Wollongbar Realm 2nd ...	Muresk Agricultural College	Guernsey...	1151	5	8	7-7-29	273	6,537	4·53	296·13	9	Bellman of Wollongbar—334
Dover 5th of Kelvin Park ...	Hospital for Insane	M.S. ...	Vol. 8	5	10	25-8-29	273	7,233	4·04	292·26	11	Daddy Xmas of Croobyar—928
Maid of Moorlands	P. Rose	Jersey ...	20896	7	3	12-4-29	210	6,195	4·63	287·37	23½	Reveller of Moorlands—1804
Parson's Red Rose 31st of Wollongbar	Dept. of Agriculture	Guernsey...	985	6	5	14-4-29	273	5,487	4·95	271·67	14	Rose Boy of Wollongbar—316
Hope of Moorlands	P. Rose	Jersey ...	13529	6	7	1-4-29	273	5,535	4·80	270·68	10	Reveller of Melrose—1804
Makanora of Grass Vale ...	C. H. Ironmonger	do. ...	12257	6	11	13-5-29	273	5,685	4·66	265·10	15	Makarini—995
Cream Duckess of Grass Vale	G. F. Coombs ...	do. ...	17531	5	10	8-7-29	240	4,740	5·48	259·90	6½	Rye Duke of Glen Iris—1994
Gladness 2nd of Wollongbar ...	Dept. of Agriculture	Guernsey...	631	7	9	1-2-29	273	4,759	5·42	258·14	11½	Faithful Fido of Wollongbar—31
Grantara Sadie	H. G. Walton ...	Red Poll ...	1233A	6	2	28-6-29	273	5,679	4·19	238·34	8	Victoria Werribee—516A
Fairy 7th of Newstead ...	T. H. Dunkley ...	M.S. ...	13605	6	11	10-9-29	210	6,045	3·71	224·25	14½	Supreme of Burradale
Grantara Jacinth	H. G. Walton ...	Red Poll ...	1231A	5	5	6-8-29	210	5,835	3·63	212·16	10½	Victoria Werribee—5116A

Fanny of Moorlands	P. Rose	Jersey ...	14843	6	1	21-5-29	180	4,455	4·57	203·91	20½	Noble's Advance of Garden Hill —2273
Countess 6th of Berry ...	T. H. Dunkley ...	M.S. ...	13347	7	6	4-8-29	240	6,195	3·16	196·35	10½	Melba's Emblem of Darbalara —461
Mercedes Sweet Ginger of Glen Iris	W. Padbury ...	Jersey ...	16679	5	0	27-9-29	150	3,315	4·66	154·53	15½	Mercedes Sweet Duke of Glen Iris—2982
Noreen 2nd of Garden Hill ...	do.	do. ...	17951	5	5	1-4-29	90	2,145	4·70	100·98	21½	Cream Socks of Glen Iris—1410
COWS OVER 4½ YEARS AND UNDER 5 YEARS—STANDARD 325 LBS. BUTTER FAT.												
Hope 3rd of the Hill ...	W. G. Burges ...	M.S. ...	Vol. 8	4	8	15-9-29	273	13,423	4·44	606·00	34½	Crescent of the Hill—2016
Koojan Dulcie	A. W. Padbury ...	Guernsey...	1255	4	11	10-3-29	273	10,036	5·71	573·94	30½	Robin of Nundorah—417
Rose 18th of Darbalara ...	W. G. Burges ...	M.S. ...	Vol. 8	4	8	30-5-29	273	10,287	4·44	457·22	19	Victor of Darbalara—2384
Dahlia 5th of Berry	do.	do. ...	Vol. 8	4	11	16-2-29	273	9,451	4·56	431·77	30½	Mirth of Berry—1716
Tessie of Garden Hill ...	W. Padbury ...	Jersey ...	17957	4	9	22-6-29	273	6,258	5·16	322·92	16	Cream Socks of Glen Iris
Spurfield Alma	Muresk Agricultural College	Guernsey...	1049	4	7	6-6-29	273	6,661	4·63	308·47	10½	Milton's Steadfast—292
Helen of Moorlands	P. Rose	Jersey ...	17961	4	7	25-3-29	210	5,040	5·44	274·41	19	Top Notch of Roelands—4011
Lassie Fowler of Moorlands ...	do.	do. ...	17963	4	7	1-5-29	273	5,200	5·07	263·74	8½	Grafter of Melrose—3560
Spurfield Air Girl 2nd ...	Muresk Agricultural College	Guernsey...	1,048	4	10	3-3-29	273	4,791	5·47	261·98	17	Milton's Steadfast—292
Wollongbar Bonnie Pearl ...	Dept. of Agriculture	do. ...	1165	4	7	31-1-29	273	4,606	5·42	249·65	10½	Bounty of Wollongbar—336
COWS OVER 4 YEARS AND UNDER 4½ YEARS—STANDARD 300 LBS. BUTTER FAT.												
Melba 69th of Darbalara ...	W. G. Burges ...	M.S. ...	Vol. 8	4	5	5-5-29	273	10,486	4·5	472·60	25½	Re-Echo of Darbalara—2254
Koojan Dame	Dept. of Agriculture	Guernsey...	1252	4	5	9-11-28	273	10,911	4·26	465·01	27	Robin of Nundorah—417
Lady Fowler 3rd of Grass Vale	R. H. Rose ...	Jersey ...	19111	4	1	27-6-29	273	8,115	5·43	440·85	10	Rye Duke of Glen Iris—1994
Lydia of Moorlands	P. Rose	do. ...	19107	4	4	3-5-29	273	6,721	4·57	307·57	5½	Top Notch of Roelands—4011
Grass Vale Fairy Rye ...	C. H. Ironmonger	do. ...	23689	4	3	8-9-29	273	6,660	4·49	299·40	15	Rye Duke of Glen Iris—1994
Wollongbar Golden Pearl 5th	Muresk Agricultural College	Guernsey...	1128	4	5	2-3-29	273	4,926	5·94	292·66	17	Judge of Wollongbar—184
Searchlight's Royal Swallow of Wangara	T. H. Dunkley ...	M.S. ...	14966	4	1	17-4-29	240	7,215	3·31	239·28	12½	Searchlight of Darbalara—2301
Grantara Hetty	H. G. Walton ...	Red Poll ...	1593A	4	1	2-7-29	273	5,263	4·14	218·14	4½	Grantara Lysander—496A
Sweet Duchess of Grass Vale	R. H. Rose ...	Jersey ...	23692	4	1	24-9-29	240	3,825	4·98	190·50	4	Starbright's Sweet Duke of Glen Iris—3710
COWS 3½ YEARS AND UNDER 4 YEARS—STANDARD 275 LBS. BUTTER FAT.												
Hope 3rd of the Hill ...	W. G. Burges ...	M.S. ...	Vol. 8	3	9	20-10-28	273	13,182	4·38	577·15	29	Crescent of the Hill—2016
Pansy 5th of the Hill ...	do.	do. ...	Vol. 8	3	10	2-12-28	273	11,607	4·13	480·35	34	Crescent of the Hill—2016
Maggie 4th of Kurrawong ...	do.	do. ...	Vol. 8	3	7	29-9-29	273	8,688	4·60	400·32	21	Premier of Kurrawong—1212
Royal Lady of Kurrawong ...	do.	do. ...	Vol. 8	3	7	13-11-28	273	9,645	4·08	393·99	35	Count Hughes of Cosey Camp —2011
Bloom of Moorlands	P. Rose	Jersey ...	20889	3	11	22-5-29	273	6,079	5·29	322·04	6½	Grafter of Melrose—3560
Beryl of Moorlands	do.	do. ...	20886	3	10	10-5-29	273	6,952	4·52	314·29	7½	do. do.
Bud of Moorlands	do.	do. ...	20888	3	9	17-5-29	273	6,081	5·0	304·65	12	do. do.
Hazel of Moorlands	do.	do. ...	20891	3	10	12-5-29	273	6,093	4·72	288·13	6	do. do.
Denmark Red Rose	Dept. of Agriculture	Guernsey...	1357	3	8	6-3-29	273	4,671	5·81	271·63	12	Rose Chief of Wollongbar—130
Grantara Daisy	H. G. Walton ...	Red Poll ...	1591A	3	10	1-8-29	273	6,246	4·30	268·88	12	Grantara Lysander—496A
Denmark Rose Pearl 1st ...	Dept. of Agriculture	Guernsey...	1430	3	8	19-7-29	273	4,863	5·50	267·56	11	Rose Chief of Wollongbar—130
Silvermine 2nd of Garden Hill	W. Padbury ...	Jersey ...	20879	3	11	25-9-29	273	4,690	5·39	253·00	18½	Cream Socks of Glen Iris—1410
Flynn 7th of Claremont ...	Hospital for Insane	M.S. ...	15066	3	11	15-9-29	273	6,603	3·81	251·81	11	Telyarup Prince of Claremont —2352

HERD TESTING, ETC.—*continued.*

Name of Cow.	Owner.	Breed.	Herd Book No.	Age. Years.	Age. Mths.	Date of Calving.	No. of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Weight of Milk Last Day.	Sire.
COWS 3 YEARS AND UNDER 3½ YEARS—STANDARD 250 LBS. BUTTER FAT.												
								lbs.	%	lbs.	lbs.	
Koojan Wavelet	A. W. Padbury ...	Guernsey...	1619	3	1	6-9-29	273	7,785	5·5	428·32	26	Robin of Nundorah—417
Koojan Dorothy	do. ...	do. ...	1613	3	3	23-9-29	273	8,361	4·99	416·94	27	Koojan Golden Governor—595
Kathleen 5th of Kurrawong...	W. G. Burges ...	M.S. ...	Vol. 8	3	2	15-2-29	273	8,875	4·32	383·49	18½	Premier of Kurrawong—1212
Daphne 7th of the Hill ...	do.	do. ...	Vol. 8	3	4	6-9-29	273	8,520	4·16	354·29	25	Crescent of the Hill—2016
Starbright's Daisy of Grass Vale	C. H. Ironmonger	Jersey ...	20373	3	3	13-11-28	273	8,019	4·27	342·69	23	Starbright's Sweet Duke of Glen Iris—3710
Koojan Dolly	A. W. Wilson ...	Guernsey...	1254	3	4	10-10-28	273	7,717	4·25	328·23	22½	Robin of Nundorah—417
Pride 4th of Kurrawong ...	W. G. Burges ...	M.S. ...	Vol. 8	3	3	14-2-29	273	8,229	3·79	312·34	23	Premier of Kurrawong—1212
Denmark Rosa	Dept. of Agriculture	Guernsey...	1429	3	4	15-4-29	273	5,880	5·26	309·70	20	Rose Chief of Wollongbar—130
Carnation of Minnathorpe ...	E. McManus ...	M.S. ...	Vol. 8	3	1	27-5-29	273	6,306	4·67	294·80	17	Bruce of Sunnyvale
Koojan Colleen	A. W. Wilson ...	Guernsey...	1293	3	3	27-11-28	240	5,670	5·06	287·19	10½	Robin of Nundorah—417
Golden Cream 2nd of Grass Vale	R. H. Rose ...	Jersey ...	N.Y.A.	3	4	22-8-29	273	5,479	5·14	281·68	11½	Rye Duke of Glen Iris—1994
Jess of Grass Vale	C. H. Ironmonger	do. ...	20872	3	5	15-1-29	273	5,728	4·64	265·87	9½	Starbright's Sweet Duke of Glen Iris—3710
Lady Fowler 6th of Grass Vale	R. H. Rose ...	do. ...	N.Y.A.	3	1	29-7-29	273	5,022	4·88	245·32	9	Carnation's Masterpiece of Grass Vale
Star Lady of Grass Vale ...	do.	do. ...	N.Y.A.	3	3	8-9-29	273	4,044	5·73	231·82	8	Carnation's Masterpiece of Garden Hill
Tessie 2nd of Garden Hill ...	W. Padbury ...	do. ...	20882	3	4	12-3-29	240	3,540	6·23	220·77	12	Cream Socks of Glen Iris—1410
Grass Vale Fairy Rye ...	C. H. Ironmonger	do. ...	23689	3	5	10-11-28	210	4,800	4·56	218·89	15½	Rye Duke of Glen Iris—1994
Pansy 2nd of Garden Hill ...	W. Padbury ...	do. ...	20879	3	5	12-3-29	120	1,935	5·85	113·31	15	Paymaster of Garden Hill—4302
HEIFERS OVER 2½ YEARS AND UNDER 3 YEARS—STANDARD 225 LBS. BUTTER FAT.												
Koojan Bonnie Jean ...	A. W. Padbury ...	Guernsey...	1612	2	7	18-10-28	273	8,164	6·19	505·39	31½	Robin of Nundorah—417
Moorlands Ada	P. Rose	Jersey ...	23679	2	11	12-5-29	273	7,563	5·26	398·12	16	Colonel of Melrose—4015
Crantock's Lady Lily ...	Mrs. Burnside ...	do. ...	N.Y.A.	2	6	26-5-29	273	6,789	5·67	384·90	18	Starbright's Sweet Duke of Glen Iris—3017
Maggie 4th of Kurrawong ...	W. G. Burges ...	M.S. ...	Vol. 8	2	7	5-10-28	273	7,371	5·01	369·88	27	Premier of Kurrawong—1212
Minnamurra Judith	Misses Giblet and Johnston	Guernsey...	1867	2	7	5-5-29	273	5,199	6·04	313·99	13	Judge of Wollongbar—184
Brookvale Noble Girl ...	G. F. Coombs ...	Jersey ...	N.Y.A.	2	11	21-7-29	273	6,357	4·74	301·76	4	Noble Lad of Roelands—3707
Wooroloo Daisy 1st	Sanatorium Farm	M.S. ...	Vol. 8	2	6	30-5-29	273	6,979	3·98	278·31	21½	Commercial of Blackheath—2001
Minnamurra Urvicto	Messrs. Giblett and Johnston	Guernsey ...	1597	2	9	12-5-29	273	5,818	4·77	277·87	14½	Minnamurra Golden Lad—402
Denmark Rosa 2nd	Dept. of Agriculture	do. ...	1793	2	6	9-8-29	273	5,196	5·28	274·33	12	Rose Chief of Wollongbar—130
Colleen 3rd of Garden Hill ...	W. Padbury ...	Jersey ...	N.Y.A.	2	10	30-1-29	273	4,359	3·78	252·24	13	Cream Socks of Glen Iris—1410
Minnamurra Fairy Queen ...	Messrs. Giblett and Johnston	Guernsey...	1592	2	10	8-4-29	273	5,134	4·77	244·87	16½	Minnamurra Golden Lad—402
Muresk Lily	Muresk Agricultural College	do. ...	N.Y.A.	2	6	26-8-29	273	4,945	4·78	236·50	13½	Triumph of Wollongbar—513
Sunlight of Wooroloo ...	Wooroloo Sanatorium	M.S. ...	Vol. 8	2	7	24-8-29	273	5,098	4·61	235·20	14½	Commercial of Blackheath—2001
Koojan Jess	Dept. of Agriculture	Guernsey...	1570	2	11	4-7-29	273	4,044	5·29	214·14	8	Koojan Golden Governor—595

Blanche 5th of Claremont ...	Hospital for Insane	M.S. ...	Vol. 8	2	7	13-7-29	273	5,442	3·80	207·23	14	Telyarup Prince of Claremont—2352
Grantara Cecilia	H. G. Walton ...	Red Poll ..	2191A	2	7	5-6-29	273	4,531	4·44	201·55	5½	Grantara Lysander—496A
Clara 3rd of Claremont ...	Hospital for Insane	M.S. ...	Vol. 8	2	7	31-3-29	273	4,600	3·99	183·65	13½	Telyarup Prince of Claremont—2352
Grantara Cynthia	H. G. Walton ...	Red Poll ...	2192A	2	9	30-5-29	273	4,542	3·87	175·91	9	Grantara Lysander—496A
Fancy of Claremont	Hospital for Insane	M.S. ...	15065	2	7	13-10-29	210	4,185	3·53	147·72	9½	Telyarup Prince of Claremont—2352
HEIFERS UNDER 2½ YEARS—STANDARD 200 LBS. BUTTER FAT.												
Kitty 8th of Kurrawong ...	W. G. Burges ...	M.S. ...	N.Y.A.	2	3	3-11-28	273	7,612	4·92	374·97	22½	Premier of Kurrawong—1212
Koojan Bluebell	A. W. Wilson ...	Guernsey...	1674	2	5	8-1-29	273	7,218	5·10	368·69	26	Robin of Nundorah—417
Koojan Thelma	A. W. Padbury ...	do. ...	...	2	4	18-9-29	273	6,549	5·46	357·80	18	do. do.
Koojan Ida	do.	do. ...	1900	2	5	1-7-29	273	6,306	5·37	339·12	22	do. do.
Moorlands Romany Maid 2nd	P. Rose	Jersey ...	N.Y.A.	2	4	6-6-29	273	5,236	5·54	290·18	10½	Colonel of Melrose—4015
Pentland Blossom 5th of Claremont	Hospital for Insane	M.S. ...	15070	2	4	14-9-29	273	6,967	3·98	277·65	17½	Telyarup Prince of Claremont—2352
Moorlands Bebe	P. Rose	Jersey ...	N.Y.A.	2	1	16-5-29	273	6,276	4·32	271·02	12	Grafter of Melrose—3560
Molly 5th of Claremont ...	Hospital for Insane	M.S. ...	N.Y.A.	2	1	10-5-29	273	6,667	3·94	262·62	22½	Searchlight of Sunnyvale
Moorlands Barbe	P. Rose	Jersey ...	N.Y.A.	2	0	14-5-29	273	5,523	4·7	259·87	11	Colonel of Melrose—4015
Carnation 2nd of Minnathorpe	E. McManus ...	M.S. ...	N.Y.A.	2	3	4-8-29	223	5,904	4·37	258·22	18	Collier of Darbalara
Redwings 2nd of Wooroloo ...	Sanatorium Farm	do. ...	N.Y.A.	2	5	24-6-29	273	7,031	3·61	254·14	20½	Commerical of Blackheath—2001
Minnamurra Joyce	Giblett and Johnston	Guernsey...	1866	2	5	9-4-29	273	6,408	3·96	254·02	21	Minnamurra Golden Lad—402
Colmyn's Lady	C. H. Ironmonger	Jersey ...	23667	1	10	14-11-28	273	5,302	4·73	249·38	17½	Milord of Roelands
Muresk Buttercup	Muresk Agricultural College	Guernsey...	N.Y.A.	2	2	26-6-29	273	4,987	4·92	245·55	12½	Triumph of Wollongbar—513
Gem of Wooroloo	Sanatorium Farm	M.S. ...	N.Y.A.	2	5	10-2-29	273	6,123	3·98	244·23	21	Commerical of Blackheath—2001
Moorlands Pearl	P. Rose	Jersey ...	N.Y.A.	2	3	16-5-29	273	4,545	5·28	240·40	10	Colonel of Melrose—4015
Moorlands Bridget	do.	do. ...	N.Y.A.	2	0	14-5-29	273	5,738	4·13	236·93	9½	do. do.
Muresk Carnation	Muresk Agricultural College	Guernsey...	N.Y.A.	2	2	12-7-29	273	4,851	4·83	234·49	12	Triumph of Wollongbar—513
Montrose Nora of Grass Vale	R. H. Rose ...	Jersey ...	N.Y.A.	1	10	15-5-29	273	4,048	5·48	221·99	9½	Montrose East of Glen Iris—4140
Karridale Nancy	A. W. Wilson ...	Guernsey...	1980	1	11	8-6-29	273	5,754	3·83	220·58	13	Minnamurra Oliver Twist—528
Biddy 8th of Claremont ...	Hospital for Insane	M.S. ...	N.Y.A.	2	0	21-8-29	273	5,538	3·87	214·71	16	Telyarup Prince of Claremont
Colmynis Topaz Girl	C. H. Ironmonger	Jersey ...	N.Y.A.	1	4	12-11-28	273	3,670	5·84	214·34	13½	Milord of Roelands
May 2nd of Wooroloo ...	Sanatorium Farm	M.S. ...	N.Y.A.	2	1	3-2-29	273	5,361	3·93	211·12	17	Commercial of Blackheath—2001
Colmynis Princess	C. H. Ironmonger	Jersey ...	N.Y.A.	2	4	7-9-29	273	4,512	4·66	210·41	14	Prince Marinora of Grass Vale—4582
Star of Claremont	Hospital for Insane	M.S. ...	N.Y.A.	2	3	1-8-29	273	5,512	3·80	209·90	12½	Telyarup Prince of Claremont—2352
Garden Hill Ice Cream 2nd ...	W. Padbury ...	Jersey ...	N.Y.A.	2	4	30-4-29	273	3,645	5·71	209·38	10	Cream Socks of Glen Iris
Lucy 3rd of Claremont ...	Hospital for Insane	M.S. ...	N.Y.A.	2	1	24-7-29	273	4,977	4·14	206·22	14	Telyarup Prince of Claremont—2352
Minnamurra Iona	Giblett and Johnston	Guernsey...	1863	2	3	6-2-29	273	3,496	5·82	203·48	10½	Judge of Wollongbar—184
Pentland Blossom 6th of Claremont	Hospital for Insane	M.S. ...	N.Y.A.	2	2	19-8-29	273	4,867	4·16	202·57	12½	Telyarup Prince of Claremont—2352
Whitby Maid 6th of Claremont	do. do.	do. ...	N.Y.A.	1	10	8-5-29	273	5,341	3·59	191·84	15½	Searchlight of Sunnyvale
Rachel 4th of Claremont ...	do. do	do. ...	N.Y.A.	2	0	7-5-29	273	5,821	3·06	178·59	15½	do. do.
Grantara Ida	H. G. Walton ...	Red Poll ...	2195A	2	3	9-6-29	273	3,522	4·24	149·62	4	Grantara Lysander—496A
Melba of Wangara	H. T. Dunkley ...	M.S. ...	N.Y.A.	2	2	30-1-29	273	3,207	4·08	131·07	9	Victor of Darbalara—2384

CENTENARY CERTIFICATES FOR SHEEP FARMERS.

The Director of Agriculture, Mr. G. L. Sutton, has made available the list of farmers, as supplied by the adjudicator, Mr. H. McCallum, Sheep and Wool Inspector, who have been awarded "Centenary Production Certificates" for wool produced by them during 1929, the Centenary Year.

Three certificates were awarded to farmers with flocks of at least 200 sheep, as under:—

Award of Merit to those whose clip averaged 12s. 6d. per head.

Award of Distinction to those whose clip averaged 15s. per head.

Award of Special Distinction to those whose clip averaged 20s. per head.

The values were based on Bradford Tops at 48d. at the time of sale, an allowance of 25 per cent. being made on the value of the wool from each ewe rearing a lamb for the season:—

	Adjusted Value per head. s.	d.
Special Distinction—		
Gerald H. York, "Fairfields," Tammin	20	0
Richard F. Thackray, "Glen Rowan," Culham	20	5
Eric W. Shenton, "Nuytsia," Quairading	21	1
Alan Murray, "Quonyonbing," Tinkurrin	21	3
John F. Harvey, "Ormidale," Lake Grace	22	6
E. M., K., and C. Allen, "Cairin," Bruce Rock	24	10
Fredk. W. Gibbs, Dinninup	23	8
Douglas Wilson, Woodanilling	20	1
Emil B. Hettner, Cherry Tree Pool, Katanning	23	9
Wise, H. J., "Wayville," Katanning	21	3
Hugh J. Haggerty, Erikin	25	10
O. P. Richardson (Estate of), "Mianelup," Gnowangerup	20	3
Alex Ball, "Rylestone," Katanning	21	1
Distinction—		
Charles Snell, "Longfarm," Nangeenan	16	6
Stephen P. Shaddick, "Mourambine," E. Pingelly	18	10
John Read, "Tokyngton," Coorow	15	7
Edgar Richardson, Jam Creek, Broomehill	19	4
Robert E. Jones, "Bellalie," Ejanding	15	9
Rollo M. Inverarity, "Booyah Park," Kellerberrin	17	3
David W. Hannan, "Mount Pleasant," Bencubbin	17	2
Arthur A. Groves, "Springhill," Tambellup	15	2
Clarence W. Fleay, "Golden Valley," Broomehill	17	11
Stanley Davis, "Condinup," Dinninup	15	10
Leonard B. Bolton, "Burlington," Namban	18	11
State Experiment Farm, Merredin	16	9
George Uppill, "Nuppin," Tammin	15	0
Frank R. Twine, "Newgain," Toodyay	16	11
Phillip J. Toll, "Jaloran," Wagin	17	5
Henry H. Kramer, "Oakbank," Wagin	17	1
Charles H. Cardwell, Noman's Lake	16	5
J. W. Cohen and V. E. Gibbs, "Wildwood," Moulyinning	16	8
Henry T. Salathiel, "Fairfields," Yealering	15	1
Thomas Skinner, "Athelstone," Carbarup	15	4

	Adjusted Value per head. s.	d.
Distinction—		
Charles Mott, "Glenalbyn," Moulyinning	18	8
Joseph O'Neill, Tambellup	15	4
Ernest A. Mouritz, "Red Hill," Gnowangerup	17	6
Leslie G. Micheal, "Hillcotte," Round Hill	19	8
Hosken Bros., Dorakin, Wickepin	15	9
David G. Sloan, "Oaklands," Williams	15	4
State Experiment Farm, Chapman	16	3
Ernest W. Watts, "Westwood," Wandering	19	7
Bertram J. Forbes, "White Rocks," Bullock Hills	16	4
Arthur J. Hunt, "White Gums," Mount Barker	16	9
James Boucher, "Gumbower," Dumbleyung	19	2
Staniforth Smith, "Culicup," Kulikup	17	1
Edward W. Rosenberg, "Sheoak Top," Wagin	15	8
Certificate of Merit—		
Sydney A. Williss, "Eatondale," Mt. Barker	14	5
Robinson Bros., "Woodillon," Babakin	13	9
Roland A. Ritson, "Daneholm," Boyup Brook	14	4
Mallet & Bielby, Meenaar	14	3
John A. Knight, "Rocklands," Corrigin	12	3
John D. Hammond, "Cuttening," Kellerberrin	13	3
Harry J. Broome, "Whitfield," Coolakin	14	10
Minchin Bros., "Maisemore," Toodyay	12	9
Cedric W. Sainsbury, "Windy Ridge," Lomos	12	6
Fordham Bros., "Glendale," Calcarra	13	9
Alwyn W. Wagner, "Tottenup," Boyup Brook	14	0
Hughes Bros., "Strathmore," Minnivale	13	10
Martin Sugg, "Dingo Dell," Kukerin	13	0
Samuel H. Rudduck, "El Cala," Coorow	14	1
Samuel B. Rudduck, "Koobabbie," Coorow	14	9
John A. Brown, "Raith," Yandanooka	14	1
Jacob McDougall, "Allendale," Datatine	14	8
Leslie M. Baikie, "Telpyn," Quairading	13	11
C. & A. H. Smith, "Sunnyside," Bruce Rock	14	6
Thomas P. Scanlon, "Hilltop," Wagin	13	3
James Curnow, "The Angle," Bulading	12	10
Alfred J. Abbott, "Carmoning," Wedgecarrup	12	8
G. F. Marsh, "Gelobine," West Brookton	13	3
Harold E. Jeffries, "Campsie," Wagin	12	8
Milo R. Keally, Woodanilling	14	9
William J. Wunnenberg, "Range View," Darkan	14	3
William J. Henderson, "Glendale," Scott's Brook	13	3
Colin H. Norman, "Romilly," West Dale	13	6
Sarah A. Gibbs (Mrs.), Boolading, Darkan	14	10
W. & E. M. Marsh, "Marshalands," Pingelly	14	3
Glen V. Mitchell, "Bickley Park," Donnybrook	14	0
Bruce H. Hobart, "Fairview," Coyrecup	13	5
John P. Ramm, "Rock Hill," Woodanilling	14	0
J. MacCallum Smith, "Homebush Stud Farm," Cookernup ..	14	8

Awards not yet available (Clips awaiting sale)—

Russell G. Bennett, "Goodworth," Dumbleyung.

Tayler Bros., "Wandin Hill," Yuna.

Bertram Torrie, "Raith," Kulikup.

HORTICULTURAL NOTES.

PRODUCTION AND EXPORT.

GEO W. WICKENS, Superintendent of Horticulture.

Owing to a light apple crop the quantity of fruit shipped from Western Australia for year ending 30th June, 1930, was less even than in the previous light season of 1927-28, and in fact was the smallest since the season of 1920-21.

The principal kinds of fruit exported from Western Australia are apples, grapes, pears and oranges, ranging in quantities in that order, but apples comprise by far the major portion of the total shipments, and a light apple crop means a small export, as shown by the following table:—

Year.	Apple Crop.	Total quantity all kinds of fruit exported.
	cases.	cases.
1927	901,464	564,412
1928	409,058	235,498
1929	1,122,173	737,676
1930	380,000 estimated) ...	227,820

The area under all kinds of fruit and production for season 1928-29 (latest figures available) and the quantities exported during the year ended 30th June, 1930, are as follow:—

FRUIT PRODUCTION AND ACREAGE FOR SEASON 1928-29.

Kinds of Fruit.	Area.			Yield.
	Unproductive.	Productive.	Total.	
	acres.	acres.	acres.	bushels.
Oranges	472	2,459	2,931	226,681
Mandarins	19	166	185	16,373
Lemons	62	466	528	58,108
Other Citrus Fruits	8	18	26	3,823
Apples	2,899	7,569	10,468	1,122,713
Pears	146	941	1,087	98,544
Peaches	161	622	783	42,348
Apricots	171	533	704	33,073
Nectarines	54	148	202	9,546
Plums	265	687	952	51,694
Quinces	25	88	113	8,438
Figs	73	311	384	34,919
Bananas and Plantains	8	11	19	563
				Value.
All other Fruit Trees	77	225	302	£6,081
				Quarts
Strawberries	...	37	37	41,812
				Value
All other small fruits	...	14	14	£218
	4,440	14,295	18,735	...
Grape Vines.				cwts.
Table Grapes	...	1,037	...	56,226
Wine Grapes	...	1,210	...	47,569
Drying Grapes	...	2,324	...	158,261
Grape Vines...	372	...	...	...
	372	4,571	4,943	262,056

FRUIT DRIED FROM THE 1928-29 SEASON'S CROP.

Raisins, Table Clusters.	Lexias.	Sultanas.	Currants.	Total.
cwts.	cwts.	cwts.	cwts.	cwts.
342	7,782	3,722	25,810	37,656

EXPORT OF FRESH FRUIT FROM WESTERN AUSTRALIA FOR YEAR ENDING 30TH JUNE, 1930.

Destination.	Apples.	Pears.	Grapes.	Nectarines.	Peaches.	Plums.	Passion Fruit.	Oranges.	Lemons.	Tomatoes.	Quinces.	Grape Fruit.
	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.
London ...	21,667	13,781¼	11,168	3	...	...	...	402	...	...	9	13
Hull	1,193	...	150	...	...	...	...	...	...	...	...	...
Southampton ...	2,049	...	100	...	...	...	...	...	...	...	...	...
Liverpool ...	2,242	80	82	...	...	...	...	...	...	...	...	...
Colombo ...	5,664	...	19,785	...	...	...	...	310	...	...	...	...
Durban ...	200	...	...	...	...	...	...	...	...	...	...	...
New Zealand ...	...	...	...	...	...	...	...	260	...	...	...	...
Hong Kong ...	...	...	...	...	...	...	...	50	...	...	...	...
Dunkirk ...	20	...	...	...	...	...	...	...	...	...	...	...
Hamburg ...	59,182½	7,583½	201	...	...	...	...	...	...	...	7	...
Rotterdam ...	249	...	50	...	...	...	...	...	...	...	...	...
Stockholm ...	39,054	265	...	...	...	...	...	...	...	...	...	...
Bombay ...	554	...	215	...	...	...	...	...	...	...	...	...
Port Said ...	6,553	...	83	...	...	...	...	...	...	...	...	...
Rangoon ...	300	...	300	...	...	...	...	...	...	...	...	...
Batavia ...	2,683	237	2,383	...	20	87	...	341	10	...	...	...
Sourabaya ...	3,410	100	1,942	...	24	81	...	124	...	...	5	...
Singapore ...	14,194	444½	6,593	17	197	210	2	793	67	31	...	...
Total ...	159,214½	22,491¼	43,052	20	241	378	2	2,280	77	31	21	13

Grand Total ... ... 227,820¾ cases.

COSTS INCURRED IN CO-OPERATIVE EFFORT TO CONTROL FRUIT FLY.

CHAS. SIMMONS, Orchard Inspector.

Following on the account of the operations of Community Baiting carried out by the Gosnells District Association, published in the September issue of this Journal for 1929, the following extracts from the Balance Sheets adopted by the Gosnells District Growers' Association, and the record books of the men who baited the orchards may be of use and interest to other circles of fruitgrowers.

The particulars published in the "Journal of Agriculture" last year show how the scheme is worked, particularly with regard to the manner of keeping records of the work, the supervision of the men employed and the number of trees that a man travelling from orchard to orchard can deal with in a day's work. The present article deals more with the cost of baiting, leaving the fruitgrower to judge as to the merits of the scheme by comparison with his individual costs and results.

In 1927-28 (Maddington-Gosnells area) during 16 rounds—29,086 trees were foliage baited at a cost of £76 5s. 9d. or .595 of a penny per tree each time the tree was foliage baited.

In 1928-29 (Maddington, Gosnells and Kelmscott area) during 18 rounds 126,918 trees were foliage baited at a cost of £201 10s. 3d. or .4 of a penny per tree each time the tree was foliage baited.

In 1929-30 (Maddington, Gosnells, Kelmscott and Armadale area) 238,197 trees were foliage baited at a cost of £377 19s. 1d. or .38 of a penny per tree each time the tree was foliage baited.

In order to make clear what is meant by the cost of .38 of a penny per tree each time the tree was foliage baited it is necessary to explain that each tree must be foliage baited every seventh day during the period commencing when the fruit is half grown until it has ripened. Thus, some trees may be foliage baited say 8 times, whilst others may require to be baited 20 times or even more. The cost given, .38 of a penny per tree, does not mean, therefore, the average cost of foliage baiting one tree throughout the season, but the average cost of one "baiting" per tree each time the trees were foliage baited on the round.

There was a considerable difference in the number of times it was necessary to foliage bait each tree. This fact is brought out by the following figures which have been compiled from the record book carried by the operator:—

Orchard.	No. of trees.	Number of foliage baitings during season.	Visits.
No. 1	1,000	8,236	22
2	1,000	5,229	23
3	750	2,558	22
4	700	6,676	24
5	650	5,625	24
6	650	2,647	23
7	150	784	23
8	100	681	24
9	50	356	24
10	25	272	23
11	25	468	24
12	12	137	24

It will be seen from the above that there were 12 orchards containing 5,112 trees, and that the number of "foliage baitings" given during the season amounted to 33,669 so that on the average each tree received 6.586 baitings. This, however, does not represent the true position for there was a considerable variation between orchards. This is brought out by the following instances. In one orchard of 1,000 trees the number of baitings was 8,236 or 8 per tree, whilst in another orchard with the same number of trees the number of baitings was 5,229 or 5 per tree. Two other comparable instances in the case of smaller orchards are even more striking—in the case of 25 trees, during the 24 visits paid by the operator during the season (18th October, 1929, to 18th April, 1930) there were 468 batings, or an average of nearly 19 baitings per tree; in the other orchard, also of 25 trees, there were 272 baitings, or on the average nearly 11 per tree.

The explanation of the disparity in the number of trees foliage baited in orchards of equal area is that in the orchards of mixed citrus, stone and pip fruits, together with figs, persimmons, etc., a greater proportion of the trees require to be treated than in an orchard almost wholly planted to one variety.

Following on the success in Fruit Fly control by Community foliage baiting in the Gosnells, Maddington and Kelmscott areas, the Armadale Fruitgrowers' Association requested that the scheme be extended to their district. On making a canvas of the town of Armadale, and the adjacent orchards, the owners of both commercial and non-commercial properties, readily acquiesced, and the result was that out of 92 small and large orchards within a radius of two miles of the Post Office, 91 joined up. The season's work was—

ARMADALE, 1929-30.

Area—91 orchards within two miles of Armadale Post Office.

Visits—24—one man employed 113 days.

Total number of trees foliage baited—91,928.

Average number of trees foliage baited per visit—3,830.

Average number of orchards visited per round—86.

Total cost—£147 14s. 8d., being—

Labour	.. ..	£102	1	6
Bait	.. ..	45	13	2

Average cost per tree per foliage baiting—.386 of a penny, being—

Labour	.. ..	.267 pence
Bait	.. ..	.119 pence

One gallon of concentrated bait was used to every 713 trees. 1,032 dilute gallons of bait were used on 91,928 trees, or 1 gallon to every 89 trees.

For the purpose of ascertaining the cost of foliage baiting the different varieties of fruit trees, the season from October, 1929, to April, 1930, was divided into three sections—

FIRST SECTION—18th October to 18th December—8 weeks—8 visits.

No. of foliage baitings applied	.. .. ..	32,512
Orchards visited	.. ..	705
Gallons of bait used	.. ..	48
Days worked	.. ..	43

Wages	.. ..	£38	14	0
Cost of bait	.. ..	19	4	0
Total Cost	.. ..	£57	18	0

Cost per foliage baiting	.. .. ..	.42 of a penny
Cost for each tree from 18th October to 18th December	.. ..	3.36 pence

The trees foliage baited during this period were late Valencia oranges, lemons, early peaches, loquats and early apricots.

SECOND SECTION—18th December to 18th February—9 weeks—8 visits.

No. of foliage baitings applied	35,250
Orchards visited	721
Gallons of bait used	48
Days worked	40
Wages	£36 0 0
Cost of bait	19 4 0
Total Cost	£55 4 0
Cost per foliage baiting	.376 of a penny
Cost of foliage baiting each tree from 18th December to 18th February	3.008 pence

The trees foliage baited during this period were mid-season peaches, apricots, Japanese plums, Bartlett pears, lemons and early figs.

THIRD SECTION—18th February to 18th April—8 weeks—8 visits.

No. of foliage baitings applied	24,166
Orchards visited	686
Gallons of bait used	21
Days worked	30
Wages	£27 0 0
Cost of bait	8 12 8
Total Cost	£35 12 8
Cost per foliage baiting	.353 of a penny
Cost of foliage baiting each tree from 18th February to 18th April	2.82 pence

The trees foliage baited during this period were late peaches, pears, apples, persimmons, plums, navel oranges and figs.

The clean crop of fruit at Armadale is the justification of the expense incurred. The commercial growers at Armadale state that for the first time for many years they were able to market their midseason and late fruits free from fruit fly, and in some instances, the first time for years, were able to sell any of the late fruits. Community foliage baiting is not wholly responsible for that improvement: the picking up of fallen fruit was also very well attended to, and the very hot weather during the early part of the summer probably checked the usual rapid increase of fruit fly.

During February when Elberta peaches, late nectarines and Bartlett pears were being picked, it required a very thorough search to find any infected fruits, and it was well into March before any increase of fruit fly was noticeable.

The fruitgrowers of Armadale are best able to testify to the success of the scheme in their district, both with regard to economy and control of the pest, and they have expressed themselves as entirely satisfied.

AN OUTBREAK OF "DOWNY MILDEW" (so-called "BLUE MOULD") OF TOBACCO IN WESTERN AUSTRALIA.

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The disease known as 'downy mildew," or, more frequently, "blue mould" of tobacco is the most disastrous disease with which the Australian tobacco-grower has to contend. The extremely serious nature of the trouble under favourable conditions may perhaps be best realised from the following quotations.

In the "Report from the Select Committee on the Tobacco-growing Industry in Australia," 1929-30, (8), occurs the statement: "The growers have hitherto proved unable to deal with the blue mould disease, which in may cases wipes out the tobacco of a whole district two out of three seasons." Adam (1), writing in the Victorian Journal of Agriculture for July, 1925, stated, "Frequently a tobacco seed-bed, containing thousands of plants in a condition ready for planting out, is ravaged to such an extent that every plant is affected. Growers, in the past, by cultivating a large number of seed-beds in different parts, especially in the hills, sought to avoid disease in some beds, and usually from these sufficient plants could be obtained for planting-out purposes. A more serious problem has arisen lately in that the disease is not confined to the seed-bed, and quite large areas of planted-out tobacco in various stages of maturity have been ruined by it."

Prior to the occurrence of the present outbreak in the South-west of this State the disease had been reported from all the mainland States of the Commonwealth with the exception of Western Australia. On the 14th August, 1930, tobacco seedlings copiously laden with the fruiting bodies of the "downy mildew" (*Peronospora sp.*) were received from Manjimup, this constituting the first record of the disease for this State. A hurried visit to the district by Mr. A. R. C. Clifton, who is in charge of the tobacco investigations in this State, and the writer, revealed that the disease had apparently been present in a mild form unrecognised for several years. A considerable number of very forward plants were affected in the earliest sown seed-beds, infection having presumably taken place from some diseased tobacco suckers which were found over-wintering in a field nearby. In view of the recently-reported proof of seed-transmission by Angell (2), it is not difficult to realise how infection may have been brought to this State in the first place. Steps are being taken to have the importation of tobacco seed to this State prohibited except for Departmental purposes, and further to prevent the sale or distribution of locally-grown tobacco seed within the State, unless it has been first disinfected in absolute alcohol by officers of this Department to destroy any infection possibly being carried by the seed. The local tobacco-growing industry is still in a condition of extreme infancy and it is worth while taking any reasonable precautions, no matter how severe, to prevent if possible the widespread distribution of the disease within the State.

CHARACTERISTICS OF THE DISEASE.

As shown by Darnell-Smith (4), a tobacco seedling may be infected in the very earliest stages, *i.e.*, when it has not yet developed its first true leaves, but is still in the "cotyledon" or "seed leaf" condition. From that time onwards, right throughout its life, it may fall a prey to the disease whenever the weather condi-

tions become suitable to the development of the fungus and the plant happens to be in a susceptible condition.

In actual practice "downy mildew" or "blue mould" of tobacco is, in most instances, very largely a seed-bed disease, although—as shown above—it may at times cause very severe losses after the seedlings have been planted out. The causal fungus (*Peronospora sp.*) is a member of the rather primitive group of fungi known as the *Peronosporales,* to which also belongs *Phytophtora infestans,* the cause of "Irish Blight" of the potato. All these fungi require abundance of moisture for their best development, and so it is only under the abnormally moist atmospheric conditions of the seed-bed that the disease is likely to be of much consequence in Western Australia. The "downy mildew" of tobacco appears to require very similar conditions to those required by "Irish Blight" for its rapid and serious development, namely, warm, muggy conditions during the day and rather cold air temperatures at night, or fairly rapid alternations of muggy and cold weather. As, therefore, the climatic conditions in the South-western area of this State are only very occasionally favourable to "Irish Blight," it would seem reasonable to suppose the same would apply to "downy mildew" of tobacco once the seedlings had been planted out. If Western Australian growers can manage to get their seedlings through the seed-bed stage they should experience very little trouble with the disease in the field under normal climatic conditions.

SYMPTOMS SHOWN BY DISEASED PLANTS.

The most characteristic feature of affected plants is the development of a dense, white or greyish down on the *underneath* portions of the diseased leaves. This downy substance is really composed of the fruiting-branches of the fungus loaded with the microscopic lemon-shaped or oval seed-bodies or *spores.* Under the microscope the fruiting structures (*conidiophores*) bear a rather striking resemblance to a dead, but still standing, karri tree, the spores being produced singly at the extremities of the many-forked branches. Under a strong hand-lens the mildew appears like a mass of densely tangled whitish scrub (Fig. 1b.). (The appellation "blue mould" was given to the disease on account of a very faint *violet* tint occasionally distinguishable in the fungal down, but the name does not seem to me at all appropriate, as, so far as my observation goes, the *least* conspicuous feature of the fungus is its supposed blueness. The name has the further disadvantage of immediately calling to mind the well-known "blue moulds" of fruit and other edible products commonly caused by species of *Penicillium,* to which the *Peronospora* of tobacco has only a distant relationship.)

Looked at from *above,* affected leaves show no evidence of the "downy mildew" itself, but the diseased plants can usually be picked out by the occurrence of irregular yellow blotches on the leaves, or by the drying-out and shrivelling-up of the diseased areas (Fig. 1a). Affected leaves are often a more or less uniform pale yellow in colour when looked at from above. Under conditions very favourable to the fungus the whole plant may soon wither up and completely collapse, but, should unfavourable conditions for the fungus ensue before this occurs, the plant may recover more or less completely until conditions are once again favourable for the further development of the parasite, when the disease may make further headway until perhaps checked yet again by unfavourable conditions. Darnell-Smith (4) records that a plant once infected is always a potential source of infection, "for example, an infected plant kept in an isolated bush house produced a crop of spores in November, another crop in the following March, and a

third crop in the following November." On the occurrence of the present outbreak it was found that infection of the seedlings had almost certainly been brought about by the blowing of *conidia* (spores) from over-wintering diseased plants.

Fig 1. *a.* (*left*). A young tobacco plant infected with "downy mildew" ("blue mould"). Note the shrivelling of the leaves indicated by the arrows.

b. (*right*). Portion of the underneath side of a young leaf infected with "downy mildew" ("blue mould"). Note the whitish, downy, growth of the fruiting-bodies of the causal fungus, *Peronospora sp.* (Magnified). *After N.S. Wales Dept. of Agriculture.*

These old plants on being examined were found in a number of cases to have several dead brown areas on a number of the bottom leaves. On the underneath surfaces of the dead tissues were found large numbers of the typical *Peronospora* conidiophores.

Fig. 2.—Adult tobacco leaf showing holes in places previously attacked by "downy mildew" ("blue mould") due to *Peronospora sp.* *After N. S. Wales Dept. of Agriculture.*

In addition to occurring on the cultivated tobacco, "downy mildew" or "blue mould" has been also recorded on a species of native tobacco (*Nicotiana suaveolens*) (1, 4). Darnell-Smith (4) reports that a *Nicotiana* closely related to *N. suaveolens* obtained from Lord Howe Island was found to be liable to infection. *Solanum pseudo-capsicum* (Jerusalem Cherry) and *Solanum sodomaeum* (Apple of Sodom) gave negative results (4).

LIFE HISTORY OF THE FUNGUS.

In spite of the fact that "blue mould" has long been a serious disease in the Eastern States and that numerous short articles on the disease have appeared from time to time in the various Agricultural Journals and elsewhere, there has apparently never been any very intensive laboratory study made of the disease, and so there are many points on which our knowledge is surprisingly meagre.

For instance, it is known that the fungus responsible for the disease may produce thick-walled resting spores in the dead tissues known as *oospores* (1), which may retain their vitality for long periods, but in what numbers they are normally produced or just how important may be their role in nature in carrying the disease over from season to season is unknown.

Another rather surprising feature is that there is very little *exact* data as to the particular climatic conditions under which epidemics of the disease occur. In this connection Darnell-Smith (5) states, "It makes its appearance particularly when the rainfall is excessive" and "a particular relationship must exist between the weather, the plant attacked, and the fungus before the latter can establish itself and spread with rapidity." Just what this relationship is, is not stated. Adam (1) in 1925 wrote, "There is a close connection between climatic conditions and the incidence of 'blue mould' disease. Data in respect of temperature, humidity, and rainfall have been collected at Wahgunyah Experiment Farm and at Buffalo River. . . . . This data, with notes on the disease obtained from year to year, will acquire more interest with the passage of time, but nothing useful can be gained from their presentation here." Mr. Temple A. J. Smith, Tobacco Expert of the Victorian Department of Agriculture, writing on "blue mould" in 1911, stated: "It is worse in or after wet seasons when the first warmth of spring is felt. (Rusty seasons for wheat are generally bad for blue mould.)" (6).

Conidia of the "blue mould" fungus apparently only remain viable for a few days. Adam (1), for example, states, "From its structure the oospore, or resting spore, is able to retain its vitality for quite long periods. In this regard it is distinct from the short-lived conidia, or summer spores, previously mentioned as constituting part of the familiar violet downy patches characteristic of the disease."

In connection with the phenomena of *infection* Darnell-Smith (4) writes—"It has been observed (in numerous infection experiments carried out with the spores of blue mould):—

1. That the spores germinate, under suitable conditions, within twenty-four hours.
2. That they produce a strong germ tube which enters by the leaf pores.
3. That, having entered the leaf, a large number of hyphae are produced in the tissues.
4. That, within eight or nine days, a fresh crop of spores may be produced from the infected leaf.
5. That a tobacco plant in its very youngest stages may become infected with 'blue mould.'"

Angell (3) implies in the following statement that under normal conditions the conidia live, at the most, only a few days, " . . . we have found that . . . under certain conditions of temperature and humidity the detached conidia of the blue mould fungus may remain viable for, and germinate after, 54 hours or more . . . ."

The same writer further states (3) that in certain experiments "the usual period of seven days required for infection was in this case, as well as in others which have come under our notice, reduced to four days, this being apparently due to the very favourable conditions of temperature (23deg. C.) (equalling 73.4deg. F.) and humidity under which the seedlings were kept and more especially perhaps to their extreme susceptibility at that age." "The seedlings used had germinated five to seven days before the experiment was carried out . . . ."

It would seem then that the optimum temperature for infection by the "downy mildew" lies somewhere in the vicinity of 73deg. F.

On the other hand, in "The Farmers' Handbook," 5th edition, published in 1929 by the New South Wales Department of Agriculture, it is stated, "Experiments conducted by the department during the last few years indicate that if the temperature of the seedlings is not allowed to fall below 45deg. F. and the surrounding air is not allowed to become humid, blue mould does not make its appearance."

We may conclude then that the conditions favouring the most rapid development and spread of the "downy mildew" or "blue mould" disease of tobacco are warm, muggy conditions during the day with low temperatures at night, or else warm, muggy periods alternating with cold ones. These conditions are similar to those required for epidemics of "Irish blight" in potatoes and various other "downy mildew" diseases of plants.

CONTROL MEASURES.

Determined efforts have been made to wipe out the "downy mildew" or "blue mould" fungus at the site of the present outbreak, but the success or otherwise of the measures taken can only become obvious as time goes on. In the event of it proving impossible to completely eradicate the fungus, growers will have to make rigorous efforts to keep the disease to the lowest possible limits, or, in other words, to "control" it.

In this connection no single measure can be relied on for success. Control of such a serious pest as the "blue mould" can only be achieved by the intelligent combination of a series of interdependent practices. These may be stated as follows:—

I. At the conclusion of the harvesting operations for the season, *i.e.*, when all the seed or leaf has been gathered, every tobacco plant on the property should be destroyed, in order to prevent carrying the fungus over from year to year on over-wintering plants. The best method of destruction would be to pull up the remains of the plants by the roots and burn them, but, if the same field is not to be used again for several years for tobacco-growing, there would be no objection to ploughing the plants under, provided that a mouldboard plough which will completely bury the tissues is used and that any suckers which may happen to grow up are systematically destroyed as soon as noticeable above the ground. Tobacco growers should regard tobacco plants growing on their properties at any other times than when being deliberately grown for seed or leaf as their worst possible enemies, from the point of view of insect and disease dissemination.

II. If possible, tobacco should not be grown more frequently than, say, once in three years on the same paddocks, as the fungus, in the resting-spore (*oospore*) stage, can apparently remain alive in the soil for a long period.

III. All seed sown should be treated before sowing in absolute alcohol for five minutes to destroy any infection possibly being carried by the seed. *The department has undertaken to treat all tobacco seed at cost price and steps are being taken under the Plant Diseases Act, 1914-26, to have the sale or distribution of tobacco seed within the State prohibited, unless and until the seed has first been disinfected by officers of this department. Under the same Act steps are also being taken to have the importation of tobacco seed from other States or overseas prohibited except for departmental purposes.* Disinfection of the seed in absolute alcohol has recently been shown by Angell (2) to be very effective, and this treatment must be considered henceforth a routine practice in tobacco culture. (Departmental experiments have shown that the germination of the seed is not detrimentally affected by as long an immersion as six and one half minutes in absolute alcohol, if the seed is spread out thinly and dried on clean blotting paper, and by evaporation of the alcohol, as quickly as possible following treatment.)

IV. After the seedbeds have been completely made up ready for planting they should be *sterilized* by the use of steam at 100 lbs. pressure for half an hour by means of the "inverted pan" system, or by the use of a strong wood fire on the site of the seedbed for at least four hours, or by watering with formalin at the rate of one gallon of formalin to fifty gallons of water, using half to one and a half gallons of solution to every square foot of soil. If using the formalin method the glass frames, or linen or hessian covers, should be put on the beds for two days following treatment, then removed and the beds allowed to air for at least 10 days before sowing the seed. The glass frames or other covers for the beds should be steamed, or watered with, or dipped in, the formalin solution, at the same time as the seed-beds are being disinfected. When stirring the beds to let out the formalin fumes, after the first two days, or to make a suitable surface on the bed to receive the seed, at the completion of the treatment, use a rake or shovel previously sterilized with steam, fire or formalin.

V. Remembering that the "downy mildew" or "blue mould" is greatly encouraged by abundance of moisture, every precaution should be taken to keep the surface of the seed-bed as dry as possible after the seeds have germinated. Every effort should be made to reduce the surface waterings to an absolute minimum or even to eliminate them altogether. This may be done by making the soil very firm during the preparation of the seed-bed so that water will readily flow to the roots by capillarity, or by watering, as in the "Marks" system (8), from a trough running along the back of the seed-bed with perforated pipes at right angles carrying the water several inches below the surface of the soil. Another good method of watering is to have agricultural drain tiles placed upright at intervals through the seed-bed, so that the water may be poured down into the sub-surface layers of the bed without directly wetting the surface or the leaves of the seedlings. Seed-beds should have a pronounced slope from the back to the front and should be so built as to lie broadside-on to the morning sun. As soon as the seeds have germinated they could be lightly covered with sterilized white sand, and a little of the sterilized sand could be sprinkled on the bed from time to time as the seedlings grow older. The sand may be sterilized by heating in shallow tins in an oven for several hours, and it could then be stored in sterilized kerosene tins until required.

The glass frames, or the linen or hessian covers to the seed-beds, should be removed every bright, dry, sunny day so as to cause hardening-up of the seedlings and prevent the steamy conditions so favourable to the "downy mildew."

VI. If possible some source of heat should be provided for the seed-beds at night, and during cold days, so as to prevent the temperatures dropping below 45deg. F., as the development of the fruiting-bodies of the fungus (and conse-

quently its rapid spread) seems to be greatly favoured by low temperatures following warm, muggy conditions just previously. Some growers make use of a fire with a straight-through or return flue *beneath the bed* to keep up the temperatures, while others have used a kerosene or petrol lamp outside one end of the bed to heat a pipe running through the frames *above* the seedlings. This would seem to be the best type, as tending to lower the humidity of the air above the bed quite considerably, but care must be taken to see that the apparatus cannot get too hot. Moreover, if this method is used, the covers to the seed-beds must be erected considerably further above the surface of the beds than is common practice at the present time.

VII. Seed-beds should be made long and narrow and not short and broad. About a yard wide should be ample. This type of construction greatly facilitates the work of weeding, transplanting, etc., and there is not nearly so much chance of spreading infection mechanically during inspection of the seedlings.

VIII. Seedlings should be lightly dusted on the *underneath* sides of the leaves with a recognised copper carbonate-sulphur dust in the event of any infection developing. This can be fairly readily applied by the use of a "sulphur bellows" provided with a straight nozzle. The bellows should be held several inches above the seed-bed at the handles and pointed forward and slightly down, so that a cloud of dust will hit the earth at a very acute angle and in glancing off and rising will come in contact with the bottom sides of the leaves. Moderation must be used in the application of the dust, and care must be taken to remove the frames whenever the sunlight becomes very hot following the treatment, or considerable "sulphur scorching" of the foliage may result.

IX. Seed-beds should be planted as *late* as possible in the spring, as the lower the atmospheric humidity during the growth of the seedlings and following transplanting the less is the danger of loss from "downy mildew." Considerably more seedlings should be raised than are actually required for planting out, and a succession of sowings in different seed-beds at weekly or fortnightly intervals may be of considerable value in ensuring that some at least will come through to planting-out time unscathed.

X. In the event of "downy mildew" breaking out in the field the plants should be sprayed with Bordeaux Mixture 3-3-50 plus ½lb. calcium caseinate to every 50 gallons of spray, taking great care to see that the bottom sides of the leaves are thoroughly sprayed. (Preparation of Bordeaux Mixture was described on page 259 and subsequent pages of the June issue of the "Journal" for 1930.) Instead of spraying, the plants could be dusted with a recognised copper carbonate-sulphur or copper sulphate-lime dust, although after planting out spraying will be found more effective than dusting.

XI. Should any plants in the seed-beds become affected with "downy mildew," they, and the immediately-surrounding plants, should be destroyed before removing from the bed by watering with a little strong bluestone solution made up at the rate of 1 lb. to 1 gallon of water. After the plants are dead, or thoroughly wet with the bluestone on the bottom sides of the leaves, they should be removed and burned.

XII. All precautions should be taken to keep down insect pests, as these are very liable to carry infection into the bed from neighbouring farms or from plant to plant in the beds. Angell (3) has recently shown that the "potato moth" or "tobacco leaf miner" (*Phthorimaea operculella*, Zell.) can readily carry infection, and the same undoubtedly applies to other insects such as the Lucerne Flea (*Smynthurus viridis*, Linn.) or the Red-legged Earth Mite (*Penthaleus destructor*, Jack.), etc.

A space free of all vegetation should be left for several yards around the tobacco beds as this will act as a good break to the lucerne flea, mite, and other similar walking or hopping insects.

XIII. Growers should refrain from visiting other growers' seed-beds, as one careless human might conceivably carry considerably greater numbers of *spores,* and for much greater distances, than could many insects.

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CONTAGIOUS ABORTION IN CATTLE.

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The subject matter contained herein is prepared with the object of assisting those cattle owners whose dairy herds are affected with contagious abortion to control the disease and eliminate it from their herds with the least economic loss. The disease is not new to this State but when it occurs the income of the dairy farmer is materially reduced by a loss of milk, loss of the calf, and time lost is treating affected animals. However, all such loss may be reduced to a minimum if the disease is understood by the farmer who, with successful treatment, prevents its progress, and the consequent sterility which commonly follows in the untreated animal. If sterility is avoided the disease is not to be feared as second abortion is uncommon.

For the purpose as stated above I am going to deal with this disease and its common sequelæ, sterility, in a practical manner.

Abortion, by which is meant the birth of the calf at any stage of development prior to the natural period of gestation, may occur as the result of accidental incidence of external forces or may be due to contagion. I intend passing over the former as any farmer who experiences abortion in his herd should in all cases act for safety and treat such cases of contagion as described below.

Contagious Abortion.—This may be defined as a disease of the womb resulting in the premature expulsion of the fœtus. It is caused by a specific bacillus which gains access to the blood by the digestive tract, and which has a predilection for the pregnant womb, and the udder of the non-pregnant cow. It sets up an inflammation therein and the result is premature expulsion of the undeveloped calf at varying stages prior to normal gestation. The period when abortion most often occurs is between the 3rd and 7th month. The casual organisms or bacilli are always present in the "Cleansings" and the discharges which come away with the imperfectly mature calf (or slink) and afterbirth. They are also found in the fæces of young calves from affected mothers. The disease, thereforce, is spread by this means, resulting in contamination of the pastures, etc.

Symptoms.—When abortion is about to occur in a cow far gone in calf no symptoms sufficient to attract attention are, as a rule, exhibited. Occasionally evidence of uneasiness and attempts to apparently prepare for calving may be observed, but generally the event occurs with no premonition to the owner. However, after parturition the udder becomes swollen, there is relaxing of the tail muscles and a discharge is noticed issuing from the vulva. Smearing of the buttocks and the tail with a discharge is a common observation.

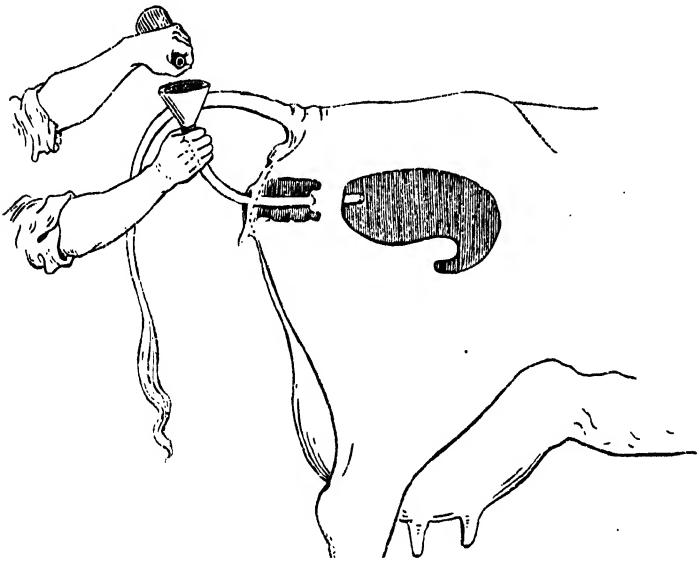
Diagnosis.—Diagnosis of the disease is made certain by the Agglutination Test which is carried out in a Laboratory. Blood samples should be forwarded to the Stock Department for this purpose. This will detect cows of which the blood is affected with the bacillus of contagious abortion.

TREATMENT.

Vaccines.—Up to the present no preventative vaccine has been produced which is efficacious. Therefore the "cleaning up" of a herd should be carried out by methods as set out below:—

1. When a cow aborts isolate her immediately, and keep isolated for four weeks.
2. Search for the fœtus (the aborted immature calf) and the afterbirth. These should be burnt thoroughly or buried deeply. When burying such material care should be taken when filling the hole to first throw in the soil removed from the ground surface.
3. Thoroughly dig up the ground afterwards together with an area of say three yards on every side and saturate the surface with a liberal supply of disinfectant.
4. The cow should be irrigated once daily for several days with the antiseptic solution perchloride of mercury (corrosive sublimate) 1 in 5,000; thence at weekly intervals if there be any discharge from the vagina. Tabloids for this purpose are specially made up and may be procured at the druggists. Such tabloids should be thoroughly dissolved.
5. The bull should be treated by irrigating with perchloride of mercury 1 in 5,000, although such animals have been proved of no potential danger unless reacting to the Agglutination test.

Method of procedure in treating cows.—For this purpose it is necessary to carry out irrigation with a 3ft. length of rubber tubing one-half inch in diameter and a small funnel which, if intended to be used with a perchloride of mercury solution, must be either of glass or enamelled metal. Other utensils used should not be of metal owing to the corrosive action of this drug. Apart from the



Method of irrigating a cow which has aborted.

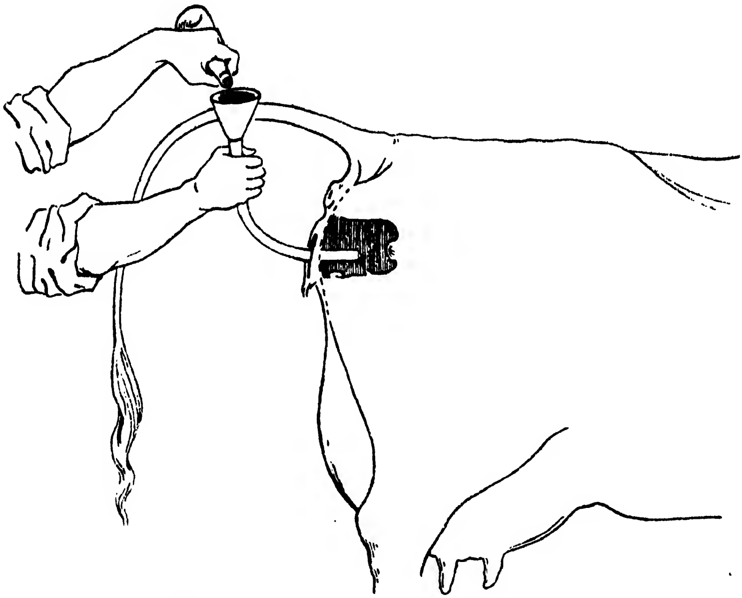
destruction of the container, chemical action takes place which renders the drug inert. For the treatment of the bull an ordinary enema syringe with vulcanite fittings should be obtained.

1. Boil for 5 minutes the tube and funnel and then apply to the outside of the tube a dressing of salad oil, good lard or vaseline.
2. Wash the hands and arms thoroughly in hot water to which disinfectant has been added.
3. When irrigating the cow pass the free end of the tube by means of the hand gently into the womb, or if the cow be sterile as far as possible into the vagina without undue force being used.
4. Hold the outer end of the tubing with the funnel inserted about six inches above the root of the cow's tail.
5. Pour the solution as described gently into the funnel and so thoroughly irrigate the parts. If the fluid does not flow freely from the tube the inner end need only be moved gently to and fro to secure a free flow.
6. Thoroughly wash down the parts from the root of the tail to the bottom of the udder, also inside of the tail with some of the same solution as used for irrigation.

7. The bull should be placed in a crush pen or otherwise made secure. Grasp the prepuce (sheath) by one hand and pass the nozzle of the syringe inside the sheath afterwards holding it in position with the same hand; with the other hand pump into the sheath a quantity of the solution to thoroughly irrigate the parts.

Disinfection of premises.—Stalls in which affected cows have been housed should be disinfected thoroughly with Izal Solution—1 in 20.

Sterility.—It is undeniable that careful and proper irrigation of the genital passages has generally resulted in the cow holding the bull after the first service. Sometimes, however, the trouble has persisted in spite of treatment, but it has not infrequently been found that the treatment has not been carried out thoroughly.



Method of irrigating a cow which is sterile.

The failure of cows to conceive after contagious abortion may be determined as due to the following causes:—

(a) Metritis or inflammation of the uterus.

(b) Cervicitis or inflammation of the Cervix.

(c) Acid solution in the passage.

The two former are undoubtedly due to neglect in treatment of the cow in the correct manner with antiseptics. The result is that a septic condition ensues. Such animals should be treated by irrigating with a solution of 1 in 2,500 of perchloride of mercury. In the latter case, where passage contents are acid, an alkaline wash is needed. The treatment necessary is to irrigate the passage just before service with a solution composed of 5 ounces of bi-carbonate of soda (baking soda) in half a gallon of water. This has often proved successful

and is specially recommended when no cases of contagious abortion are present in the herd and there is nothing to suggest that the contagion of this disease is responsible for the animal's failure to conceive.

Improper management of the bull is often the cause of cows failing to conceive. It is a bad practice to allow the bull to run at large with the herd. Such a practice has a tendency to overwork the bull and he becomes stale. If is far better to provide a special enclosure for the bull and bring the cows to him when ready and remove them again when properly served. The number of cows served during the year at regular intervals should be from 50 to 60 for each mature bull, whilst young bulls should be used sparingly. Bulls should be well fed and kept in good conditions—not overfat.

The improper use of perchloride of mercury should be avoided when irrigating the vagina. At least 48 hours should lapse between the time of irrigation and the time of service.

TOMATO CULTURE IN WESTERN AUSTRALIA

(Continued).

E. T. MORGAN,
Vegetable Inspector.

Selection of Soil.

The ideal soil for the production of the tomato crop is a good sandy loam which can be easily cultivated, thereby retaining moisture. For the early crop, land with a northerly aspect, which is in a warm situation, is the most suitable. Although a sandy loam is desirable, tomatoes are grown on many different classes of soil, but where the land is of a clayey nature, drainage must be provided, also cultivation must be carried out at the proper time, as the working of these soils in a wet condition, tends to make the surface bake and crack when subjected to warm dry weather, and moisture is therefore lost. However, when well and properly cultivated much of this type of land is producing good crops. The rich gully land of the hills and the river flats of the South-West are ideal spots for tomato culture. The border land of our peaty swamps is excellent for the growing of early crops, and the swamps have proved themselves to be ideal for the cultivation of the late crop. The Geraldton and Carnarvon districts, with their early seasons, are favourite tomato growing areas and the acreage is being increased yearly.

Drainage.

Many of our tomato growing localities do not require draining. This is generally the case with the border land of our swamps and on sandy loams with a free subsoil but where there is excess moisture this prevents æration, keeps down temperature, and retards plant growth. Soil warmth is greatly increased by proper drainage and this is an important feature when dealing with the production of an early crop. Also, well drained land is workable earlier than one which is in a sodden condition.

Irrigation.

The early crop, except in very light porous soils, seldom requires watering as sufficient rain usually falls to see the crop through. If the soil dries out, water must be applied. Water may be supplied by means of furrows or drains, and overhead sprinklers. Overhead sprinkling is the most satisfactory method, and where this system is utilised a very even distribution of water is possible. Where irrigation is practised by means of furrows, great care must be exercised in its application, as too much water is just as detrimental to the growth of the plants as is too little. On well graded land, however, watering is satisfactorily done by this method.

Manuring.

No crop responds more readily to correct manurial treatment than does the tomato. In order that plants may develop and mature normally, ten essential plant foods are necessary. Fortunately for us, most of these elements are contained in our agricultural soils and it is generally only necessary to supply phosphates, potash and nitrogen to ensure good results. These three plant foods must be balanced, as it is impossible for an excess of one constituent to make up for the lack of another. Each plant food ingredient has a duty of its own to perform. Briefly stated, the functions of the main plant foods as stated above are—

Nitrogen.

Nitrogen promotes the vegetative growth of the plant. Excess of nitrogen, with sufficient moisture, tends to make top growth, often to the detriment of the fruiting of the plant. A deficiency of nitrogen is seen in the general stunting of the plants and a yellowing of the foliage. The commonest form of nitrogenous fertiliser used by growers in this State is sulphate of ammonia. It is very soluble in water, therefore is quick acting. Nitrogenous manures, judiciously used, maintains growth at its maximum, without affecting the fruit-bearing qualities.

Phosphates.

Phosphates have important functions to fulfil, particularly the stimulation of root development, whereby a vigorous root system is produced. They also stimulate the flowering system of the plant and hasten ripening. Superphosphate and bonedust are the most generally used phosphatic fertilisers.

Potash.

Potash is an important constituent for plants which produce mainly carbohydrates, such as starch and sugar. It influences to a great degree the health and growth of plants. Plants are said to be more resistant to disease when well supplied with potash. Potash improves the carrying as well as the eating qualities of the fruit, besides increasing the proportion of marketable produce in the tomato crop. Sulphate of potash is the most generally used potassic fertiliser in this State.

Fertilising, therefore, should be done with a well balanced mixture, and where stable manure is obtainable, this commodity, in conjunction with a dressing of artificial manure, will maintain good growth and produce a satisfactory crop. Where stable manure is not procurable, the ploughing in of green stuff will furnish humus so necessary to our soils. As the tomato plant continues fruiting over a rather lengthy period it is a wise plan to fertilise with artificial mixtures at in-

tervals rather than to apply a heavy dressing at the time of planting out. Mixtures that have been found to give satisfactory results are Mount Lyell No. 4, Cuming Smith "E" Brand, and Cresco special potato manure. Blood and bone manure is used by many of our market gardeners with good results, but as the phosphoric acid contained in this mixture is only slowly available, the addition of superphosphate is beneficial. A mixture of four parts blood and bone, two parts of superphosphate, and one part of sulphate of potash is recommended as a good combination for many vegetable crops and for tomatoes has produced fine crops. It is suggested that from 15 to 16 cwts. is applied per acre, although many growers use a ton or more per acre with increasingly good results. If half the quantity per acre is applied at the time of planting and the other half when the plants carry their first flowers, the results should be most gratifying.

Stable manure may be broadcast and ploughed in prior to planting out, or may be applied in the holes excavated for the reception of the plants, mixing the manure, together with the artificial fertiliser, well with the soil.

Heavy dressings of nitrogenous fertilisers are not advised for the tomato, as rank top growth may be induced to the detriment of the fruiting qualities of the plant. Heavy top growth is not generally conducive to good fruit setting. Where plants have been bearing heavily, a dressing with a nitrogenous fertiliser is beneficial and will prolong the growth of the plant with increased fruit production. Sulphate of ammonia applied near the plant and watered in, if dry weather is experienced, is recommended, or as a liquid manure, a large handful in a kerosene tin of water should be applied round the base of the plant, not allowing it to come in direct contact with the foliage or slight burning may take place.

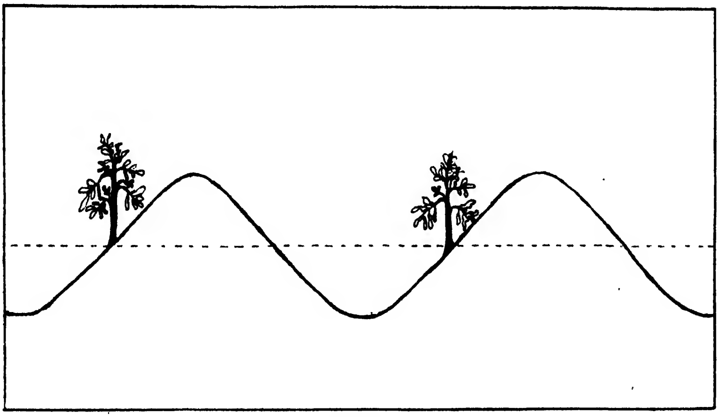


Fig. 1.

Transplanting.

When the plants have attained a height of from six to eight inches, they are ready to be removed to their permanent position. As the plants for the early crop are planted out in the beginning of winter, it is advisable to put the land up in ridges in order to facilitate drainage. The land to be utilised having been thoroughly worked, ridges are quite easily struck out with the plough. Manuring may be done at the time of ploughing. It is suggested that a furrow is ploughed each

way along the line to be planted, which should be marked out with sticks prior to the commencement of operations, allowing about three feet between the rows, so as to leave a V-shaped channel. The manure may be sown along this furrow. If the depth of ploughing is then increased and the furrows are ploughed back to form a ridge, the results will be a row ready for the putting out of the young plants. The young plants, when removed from the seed bed, should have their roots kept moist and protected from the effects of drying winds, if such obtain at the time of planting. The plants should be placed on the side of the ridge (as illustrated) instead of on the top—the earth at the back making for the protection of the young plants during stress of weather. Later, when the weather becomes warmer, the whole of the land may be levelled, this process being done without disturbing the root system, so leaving the soil well and deeply worked, and enabling the plants to maintain a regular and healthy growth.

Cultivation.

Cultivation should be carried out systematically in order to conserve moisture, aerate the soil and keep down weeds. No hard and fast rule can be laid down as to the number of cultivations necessary. This the grower will decide for himself. Where the land has been well prepared and the soil moisture has been maintained by thorough cultivation, there is seldom any necessity for irrigation in the growing of the early crop, but where irrigation has been done the land should be cultivated after each watering in order to maintain a fine surface mulch and to avoid baking and cracking of the soil.

Spacing.

No hard and fast rule can be laid down as to the distance apart that the plants shall be spaced. This depends a lot on the variety, district and time of planting. When the plants are staked and pruned it is usual to space the rows 3 to 4 feet apart, with the plants about 18 inches to 2 feet apart in the row. This will give ample room to allow of cultivation between the rows. A width favoured by many growers is 3 feet apart each way. This width allows for good growth of the plant without crowding, and permits cultivations and spraying.

Pruning.

In order to obtain the best results, tomato plants should be systematically pruned. Pruning often takes place in the seed-bed, as when plants are weak and spindly, pinching out the terminal bud will produce a more stocky and vigorous plant.

The main pruning is done when the plants are put out in their permanent positions, and consists of pinching out the superfluous laterals that start from the axil of the leaves on the main stem or stems. (See Fig. 2, p. 484.)

When the plants are staked, they are usually pruned to a single stem, which is topped when it reaches the top of the stake to which it is tied. The whole energy of the plant is then directed to the production of fruit, but sufficient foliage must be allowed to remain in order to allow of proper assimilation and to protect the fruit from sunburn. Pruning is recommended for the early crop, but the late crop

is seldom treated as the hot sun tends to burn the fruit, but some pruning can be done with beneficial results, as the checking of excessive leaf growth encourages fruit production.

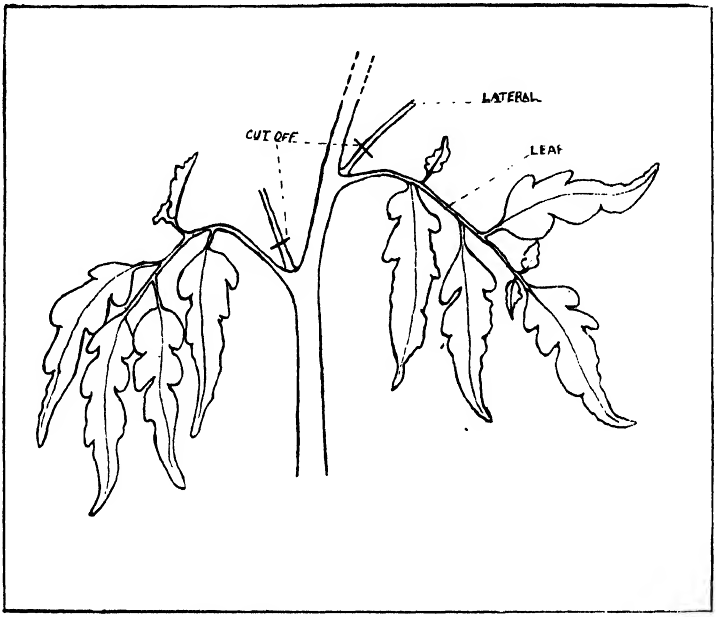


Fig. 2.

Trellising.

To obtain the best results, tomato plants should have some kind of support. To allow the plants to roam all over the ground, with the likelihood of the fruit getting dirty and worm eaten, is bad business; rot is encouraged by the fruit lying on the damp ground, cultivation is interfered with, and picking and spraying for the control of insect pests are rendered difficult.

Several methods of support are adopted by growers. Mulching with straw or other litter between the rows is carried out. This method certainly keeps the fruit off the ground, but better results are obtained by staking. Trellising may be carried out by running wires between posts placed at either end, one wire about 2 feet from the ground, and the other about 18 inches or 2 feet above this, a stake being placed near each plant, so that the main stem may be tied as growth proceeds. Another method is to build a framework with light saplings on the same principle. This is adopted by at least two of our most successful growers in the Balcatta district.

Another method of support, largely adopted in the metropolitan area, is to place four stakes about 4 or 5 feet long around each plant; strips of bagging about 1½ inches wide are fastened round the stakes at about a foot from the ground, and, as growth continues, further strips are used higher up the stakes. It is not advisable to have the stakes too close in to the plant, or the tendency will be for the plants to be bunched too much, and not allowed sufficient sunlight to enable the plant to do of its best and mature its fruit.

Gathering and Marketing.

The exact stage of ripeness at which the fruit is gathered depends on the market to which it has to be sent and the time occupied in the transit thereto. In no case, however, should the fruit be picked until it has fully developed, which does not mean that it is showing colour, but that the pulp surrounding the seeds has filled the inside cells of the fruit and is becoming jelly-like.

In most varieties there is a slight fading of the dark green colour of the skin at the apex of the fruit, as well as slight browning at the point at which the fruit is attached to the stem. If gathered at an earlier stage the flavour will never be fully developed. Gathered at this stage it can be sent to distant markets without difficulty, but where the market is close, the fruit may be allowed to become coloured before being picked. As the fruit, once it has become fully developed, matures rapidly, it is necessary to go over the plants frequently, as if this is not done a quantity of the fruit is apt to become over-ripe and unsuitable for market.

The produce should be handled carefully and all badly blemished or diseased fruit discarded. These should not, however, be left lying on the ground, but should be destroyed, as diseased fruit lying about may be the means of spreading disease throughout the garden.

The sound fruit is taken to the packing shed, where it is graded and packed, usually in cases containing ¾ of a bushel. Grading should be done on the basis of colour as well as size. It is a mistake to pack green and coloured fruit in one case; if each is placed in a separate case better prices will generally be realised.

THE PRODUCTION OF LAMBS FOR EXPORT.

GEO. L. SUTTON, Director of Agriculture.

It is apparent that the production of lambs in this State now exceeds, and will continue to exceed, to a greater extent than at present, the requirements for local consumption. The production of lambs for export is, therefore, obviously called for.

Probably no branch of the sheep industry furnishes such quick returns. Though the price of export lambs is lower than that which has obtained for those purchased for local consumption, yet a well-grown lamb four to five months old is frequently worth more than a wether several months older, and the profits from lambs are not unlikely to be greater than those of a whole year from even the most profitable wool types. Lamb raising, too, is eminently suited to the conditions of our agricultural areas, in that it enables the maximum number of stock to be carried during our mild winter when the feed is most succulent and most abundant, and enables the numbers to be reduced to the minimum when our pastures are driest and scantiest.

Standards for the local lamb market are considerably less exacting than those necessary to satisfy export requirements. For local consumption a well-grown, "fresh" or "sappy" Merino lamb is suitable, though not so for export purposes; it does not possess the necessary bloom, nor is the colour satisfactory. The requirements for export are that the carcase shall be fresh and not dry, compact and symmetrical, evenly coated with flesh, but not over fat, with light bone, thick shoulders, a plump leg and good loin. This necessitates the U-shaped hind-quarters rather than V-shaped lankiness, which always results in a reduced price.

Definite information regarding the unsuitability of the pure Merino lamb for export is furnished by the experiments conducted at Roseworthy, South Australia. These showed that not only did such a lamb mature too slowly, but that 18.33 per cent. failed to reach even the third-quality standard for the export lamb. Of those which reached the export standard, 40 per cent. were classed as third-quality grade; 33⅓ per cent. as second-quality only, and 8.34 per cent. as first-quality.

Just as there is need for specialisation in other avenues of agricultural production, so there is need for it in lamb raising, and this requires that the lamb raiser shall mate good ewes (not necessarily young ewes) of one type with rams of one pure breed. It must be understood, of course, that the rams on different farms need not be of the same breed. To produce the essential carcase requirements for export lambs already specified, the animal will require to have a compact, symmetrical body, wide chest, broad back, thick flanks and short legs.

There is absolute unanimity amongst those experienced in the lamb export trade in Australia, New Zealand, and Great Britain that no animal will conform to this description unless sired by one of the Downs breeds. *To achieve full success the use of a Downs ram is imperative, and which should be mated with Longwool Merino crossbreds rather than with Merinos.*

The "Downs" sheep, which are best known in Western Australia, are the "Dorset Down," or, as it is more commonly called, the "Dorset Horn," the Shropshire" and the "Southdown," and it is suggested that the merits and possibilities of these, under Western Australian conditions, be thoroughly determined before recommending, for general use, the lesser known Suffolk, Oxford Down, Hampshire Down, or others.

Quick maturity in connection with lamb production is essential, as the lambs should not be weaned before being marketed. Further, they require to be marketed unshorn, and before they are likely to suffer from the effects of grass and other seeds.

Of the better known breeds referred to, the Dorset Horn lamb is more vigorous, and matures more quickly than the Shropshire. The Southdown lamb matures least rapidly of the three breeds referred to, though it is generally recognised that the progeny of this breed has the most shapely carcase. This advantage, however, may be more than offset in this State by the quicker maturing qualities of the other two breeds, and the need for quick maturity in a short season. Further, for some years to come it is certain that the Merino will be required to be used as the mother, and in this connection there is a very general belief that the Dorset Horn is more suitable for mating with the Merino than the other two breeds. On this point there is a great need for definite information under our local conditions, and with this object in view experiments have been planned to be carried out at the Avondale State Farm, whereby the Dorset Horn, Shropshire and Southdown rams will be mated with both Merino and with Border Leicester-Merino ewes in order to determine the type of lamb produced when mated as indicated.

The relative export stage maturity of the different types of lambs is approximately as follows:—

Dorset Horn × Longwool Merino Crossbred—14 to 16 weeks.
Shropshire × Longwool Merino Crossbred—15 to 17 weeks.
Southdown × Longwool Merino Crossbred—16 to 18 weeks.
Merino—18 to 22 weeks.

Because of the specialisation in wool, which has been practised in Western Australia in common with other parts of Australia, the predominant type of ewe available for lamb production is the Merino, and, in consequence, at present, and for some years to come, it is this ewe that will be used. The Merino ewe, however, is not very suitable for the purpose; in the first place it is slow maturing, and, because of this characteristic, its milk supply is comparatively light and not sufficient to properly satisfy the needs of a vigorous and quickly maturing crossbred lamb of the Downs type. For this purpose a ewe of the Downs type would undoubtedly be the most suitable, but there are not sufficient in Australia to meet the needs of our lamb raisers. Further, it must not be forgotten that the dam of the export lamb has to be carried over the whole year, during which time it is producing a fleece. The wool it carries should, therefore, be of the most valuable kind and the largest quantity possible under the circumstances. Ewes of the Downs type are very much inferior in this respect to the Merino, which stands supreme.

Though the Merino is essentially the predominant wool type, it is not the only good wool type, and the experiments conducted at Roseworthy in South Australia, and at Bathurst, Cowra and Wagga, in New South Wales, have shown that, as the result of mating British rams of the long-wool type with the Merino, a crossbred ewe is produced, which makes an excellent mother for the export lamb, whilst at the same time producing a very profitable fleece. Further, many of the progeny, particularly of the "English Leicester" and "Border Leicester," are first-quality export lambs. In this connection it is pointed out that it is by the use of such crossbred or halfbred long-wool ewes mated with rams of the Downs type that many of the famous Canterbury export lambs of New Zealand have been produced.

The experiments referred to were conducted with "Lincoln," "English Leicester," "Border Leicester," and "Romney Marsh" rams mated with Merino ewes. A mass of information has been obtained from them, which shows that the Lincoln-Merino crossbred invariably produces the greatest weight of fleece, and the Border Leicester crossbred invariably produces the earliest maturing mother and the heaviest body weight, both as a lamb and an adult sheep, whilst the English Leicester-Merino crossbred produces the most shapely type of animal and finest

wool. The "Romney Marsh," when mated with the Merino, produces a good fleece, though a less shapely animal, but in districts where Foot Rot is likely to be troublesome, the Romney is to be used despite this slight drawback, for it possesses very strong inherent resistance to this disease.

The experiments show conclusively and very definitely that, whereas the Merino ewe itself is not very suitable, yet when mated with any of the long-wool breeds referred to—"Lincoln," "English Leicester," "Border Leicester," or "Romney Marsh"—a ewe is obtained which is admirably suited for mating with a ram of the Downs type in order to produce fat lambs, either for local consumption or for export.

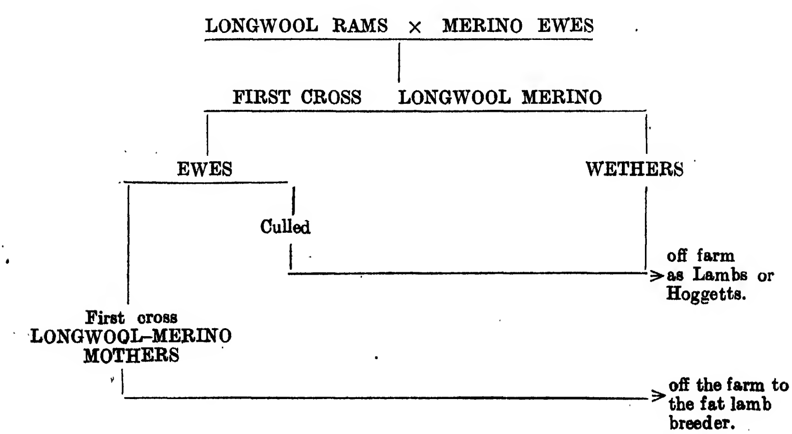
It is sometimes claimed that the "Corriedale" can take the place of the Downs sire. It is, however, believed that it is more suitable to take the place of the Long-wool-Merino crossbred, and when used in this way should be mated with a Downs ram.

The production of fat lambs may, therefore, be divided into two distinct stages—the first stage, the production of the crossbred long-wool mothers by mating the Merino ewe with rams of either the "Lincoln," "English Leicester," "Border Leicester," or "Romney Marsh" breeds, and the second stage, the production of the fat lamb by mating the long-wool crossbred mother with one of the Downs rams, *i.e.*, Dorset Horn, Shropshire or Southdown.

Because of its quick maturing qualities, with ability to produce the greatest body weight, the Border Leicester is likely to suit those districts where the rainfall is lightest and pastures scantiest. It will prove least suitable where the rainfall is heaviest, and particularly in those districts subject to worm infestation, for the "Border Leicester" is particularly subject to these parasites. On better pastures and rich land the "English Leicester" and "Lincoln" can be used to advantage, whilst in districts subject to Foot Rot the "Romney" will prove most suitable. Similarly the "Dorset Horn," because of its vigour and early maturing, is likely to prove more suitable than the "Shropshire" or "Southdown" for districts in which the period over which succulent pastures are available is shortest.

The two stages necessary in connection with the production of fat lambs may be shown graphically as follows:—

FIRST STAGE.



SECOND STAGE.

FIRST CROSS DOWNS RAMS × LONGWOOL-MERINO MOTHERS

EWE LAMBS — WETHER LAMBS

Off the farm as Lambs.

It is important to realise that the progeny of the second cross is an unprofitable wool producer, and, as shown in the diagram, lambs of both sexes should be marketed as lambs. Unless the conditions are such as will ensure this, the farmer should devote his attention to the raising of the Longwool-Merino crossbred mothers, or of pure Merinos.

Because it is unprofitable to carry over lambs sired by Downs rams, whether from Merino or crossbred Merino ewes, and because the Longwool Merino crossbred ewes are such good mothers, and a large percentage of both ewe and wether lambs are first-quality for export, if well fed, it is recommended that the Merino ewe be mated with a Longwool ram rather than with a Downs ram.

Though breeding on the right lines is essential, proper feeding is also necessary.

Success with the export lamb involves a rapid increase in body weight from the time it is dropped until sent to market. This demands a much better food supply than is necessary in the case of the more slowly maturing Merino. This need is to some extent provided for by using the crossbred long-wool dam whose milk supply is much superior to that of the Merino ewe. In order that this milk supply may be available at the birth of the lamb, and maintained afterwards—for the lamb should be fed mainly through its mother—the needs of the dam are such that it should not be short of food prior to lambing, and further, should have an ample supply of succulent food after lambing. In most districts this will necessitate the growing of crops to provide succulent food before such is normally available, and later to supplement the pastures. For this purpose such crops as the early maturing varieties of oats—Mulga and Burt's Early—rape and barley are admirably suited. Where conditions suit it nothing is better than lucerne. On farms where the feed is very watery it may be necessary to supplement the over-succulent pasture with some dry feed in order to secure the bloom and finish necessary on the export lamb.

Because the export lamb must be sold as a sucker, unremitting attention to the needs of its mother and itself is necessary in order to ensure that it shall not suffer any check and its growth be hindered by rough handling and unnecessary movement. For this reason the lamb marking should be carried out with the greatest of care to prevent injury to the muscles. To avoid undue loss of blood and to prevent excessive shock the lamb will require to be marked at an early age, say, when 10 to 14 days old, and this will necessitate two or more markings. To avoid unnecessary handlings and bruising a drafting race and suitable yards are essential when selecting a line for market.

Each quality of export lambs is graded according to weight. The carcase weights of the different grades on the hooks at the freezing works are as follow.—

1st Grade—28 to 36 lbs.
2nd Grade—37 to 42 lbs.
3rd Grade—43 lbs. and over.

The 1st grade may be set down as being usually worth ½d. per lb. more than the 2nd grade, and ¾d. per lb. more than the 3rd grade. The grades are known in the trade as "2," "8," and "4" respectively.

The South Australian experiments show that the Merino lamb loses about 59 per cent. of its live weight from farm to the carcase weight at the freezing works,

whilst the Downs Longwool-Merino lamb loses about 54 per cent. Using these figures it follows that on the farm the live weights of well finished Merino lambs intended for export should range from 70 to 90 lbs. and of Downs crossbred lambs from 60 to 80 lbs.

Because of the necessity of having the lambs well finished and ready before the grass and other seeds are troublesome, it is necessary to have them dropped early, say, in April, and, if the pastures cannot be relied upon to produce suitable succulent feed for the ewes at this time, such should be provided by means of grazing crops or by silage.

Lambing in April means mating in November, and, as the British breeds do not readily mate as early as Merinos, it is advisable to use 2½ per cent. of rams rather than 2 per cent. as is the case with Merinos.

Crossbreds have the advantage that they are decidedly better scavengers than Merinos and, therefore, are more suitable for cleaning fallows and controlling weeds. They, however, require better fences to hold them, and, in fact, it is doubtful whether any fence other than a netting fence can be relied upon.

If all the stages connected with the production of fat lambs are carried out on the one holding the work requires considerably more forethought, and becomes considerably more complicated than is the case in connection with the production of wool from a Merino flock. It necessitates facilities for mating with three different breeds of rams—Merino, Longwool and Downs—and the carrying of three distinct flocks, viz., a Merino flock, a Longwool-Merino flock, and the Downs lambs. Very few holdings can provide these facilities, and it is believed that export lamb production can never occupy the important position it should in connection with Western Australian agriculture unless the farm management work associated with it can be simplified so that any farmer need only keep one breed of ram. It is believed that this can be achieved if the two stages of lamb production already referred to be considered as separate and distinct activities of individual farmers. Thus, some farmers will raise the Longwool-Merino mothers, as the result of purchasing Merino ewes and mating them with a British Longwool ram, and others will produce the export lamb by mating a Downs ram with the Longwool-Merino mother purchased from those raising it. In this connection it will be found that all districts in the agricultural areas are not entirely suitable for the production of fat lambs, and, in consequence, it is expected that export lambs will be produced mainly in the later or wetter districts, the Crossbred mothers in the intermediate, and the Merino mothers in the pastoral and the very early districts of the Wheat Belt.

SUMMARY.

The sire of the fat lamb for export should be a—

"Dorset Horn," "Shropshire," or "Southdown."

The mother of the export lamb should be a Longwool-Merino crossbred ewe, if available.

If crossbred ewes are not available, mate the Merino ewe with a Longwool ram.

Mating should take place in November, and provision made for ample succulent feed in April, and thence onwards by means of fodder crops or silage.

Well finished, light-weight lambs bring highest prices.

Lambs should be handled carefully, fed through, marketed unshorn and direct from their mothers.

The later and wetter agricultural districts are most suitable for the raising of the lamb for export.

The intermediate districts for the Longwool-Merino crossbred mothers, and

The pastoral and very early districts of the Wheat Belt for the Merino mothers of the Longwool crossbreds.

AGRICULTURAL SEEDS AND THEIR WEED SEED IMPURITIES.

H. G. ELLIOTT, Dip. Agric.
Assistant Plant Pathologist.

With the exception of seeds of Wheat, Oats, Barley, Subterranean and Drooping Flowered Clovers, the majority of the agricultural seeds sown in Western Australia are imported either from the Eastern States or overseas countries.

It is well known that the average sample of clover or grass seed has greatly improved in quality, especially as regards cleanliness and purity from weed seeds, during the past thirty years. This improvement is due to—

1. The great improvement of harvesting and cleaning machinery.
2. The purchase of seeds from reliable firms.
3. The establishment of seed testing stations.
4. State and Commonwealth Acts which prohibit the sale or entry of seeds containing noxious weed seeds.
5. The farmers' better knowledge of the harm done by sowing noxious weed seeds.

However, despite all these factors which have tended to raise the standard of the seeds sold, there are still many very inferior grades of seed on the market to-day. This is due to the purchaser's ignorance of the amount of harm done by certain weeds, and to his not being able to recognise the weed seeds present in a bad sample when he sees it, or to his desire to purchase a cheap line without a guarantee.

The presence of weed seeds in agricultural seed is the rule rather than the exception. It is very seldom that commercial seed is free from some seeds of weeds or other crops.

Perhaps it would be advisable to define what is meant by "Weed Seeds." From a farmer's point of view, any plant out of its place, even if it is a useful one, is a weed, so that if he buys, for instance, subterranean clover containing turnip seed, or *vice versa*, he is sowing a weed, although, in their places, both are valuable plants.

Wheat, Oats and Lucerne are amongst the cleanest of machine-threshed crops, but a certain sample of imported lucerne seed examined contained no fewer than 23 species of weed seeds, four of which were noxious under the State Agricultural Seed Act, 1923.

The introduction of new and foreign species of weed seeds is due, in most instances, to their presence in consignments of grass, clover or other commercial seeds from overseas and the Eastern States. Thus it can be seen how foreign weeds may result from the direct planting of crop seeds containing such seeds.

Certain weeds, either because they possess poisonous qualities, or because of the difficulty of eradicating them when they are once established, or from the harm they do to the crop, are called noxious weeds.

The revised list of noxious weeds under the Agricultural Seeds Act, 1923, as gazetted on page 1828 of the *Government Gazette*, 15th August, 1930, is as follows:—

Alternanthera Achryantha, var echinata	(Khaki Weed).
Ambrosia spp.	
Argemone mexicana	(Mexican Poppy).
Asperula azurea	
Asphodelus fistulosus	(Onion Weed).
Bartsia viscosa	(Yellow Weed).
Bartsia trixago	(Sticky Weed).
Brassica sinapistrum	(Charlock).
Brassica Tournefortii	(Wild Turnip).
Bromus secalinus	(Cheat).
Carduus spp.	(Thistles).
Carthamus spp.	(Thistles).
Centaurea spp.	(Thistles).
Cnicus spp.	(Thistles).
Cuscuta spp.	(Dodder).
Chondrilla juncea	(Skeleton Weed).
Cucumis myriocarpus	(Paddy Melon, or Gooseberry Cucumber).
Cyperus spp.	(Nut Grass).
Datura stramonium	(Thorn Apple).
Echium spp.	(Viper's Bugloss).
Emex australis	(Double Gee).
Euphorbia segetalis	(Carnation Weed).
Euphorbia terracina	(Carnation Weed).
Foeniculum vulgare	(Fennel).
Galium aparine	(Cleavers).
Gilia squarrosa	(Californian Stink Weed).
Gomphocarpus fruticosus (Asclepias fruticosa)	(Cotton Bush).
Guizotia abyssinica	
Homeria collina	(Cape Tulip).
Hypericum perforatum	(St. John's Wort).
Inula graveolens	(Stinkwort).
Iva axillaris	(Poverty Weed).
Kentrophyllum lanatum (Carthamus lanatus) ..	(Saffron (Star) Thistle).
Lactuca scariola	(Wild Lettuce).
Lapsana communis	(Nipplewort).
Lepidium Draba	(Hoary Cress).
Lupinus luteus	(Yellow Lupin).
Lychinis Githago	(Corncockle).
Onopordon spp.	(Thistles).
Opuntia spp.	(Prickly Pears).
Orobanche cernua	(Broom Rape).
Polygonum spp.	(Bindweed).
Raphanus raphanistrum	(Wild Radish).
Reseda luteola	(Wild Mignonette).
Romulea rosea	(Guildford Grass).
Salsola Kali-tragus	(Russian Thistle).
Saponaria vaccaria	(Cowcockle).
Solanum sodomaeum	(Apple of Sodom).
Solanum rostratum	(Buffalo Burr).
Sonchus arvensis	(Perennial Sow Thistle).
Sonchus asper	(Rough Sow Thistle).
Tripteris clandestina	(Stinking Roger).
Tussilago farfara	(Coltsfoot).
Xanthium spp.	(Burrs).

NOTE.—This means that the sale or exposure for sale of samples of seed containing any of the above weed seeds is illegal under the Agricultural Seeds Act of Western Australia (1923).

Foreign Seeds found in Commercial Seed Samples.

The following named species of weed or foreign seeds have been found in commercial samples of seeds examined during the past seven years. All the seed samples were either offered for sale in this State or examined under the Commonwealth Quarantine Regulations.

[Except where otherwise stated (by numbers in brackets after the name) the weed seed impurities have only been found once.]

I. GRAMINEAE.

Scientific Name.	Common Name.
i. Andropogon (Sorghum) sudanese	Sudan Grass
Containing :—	
A. *Legumes*—	
Medicago denticulata	Burr Medic (2)
M. sativa	Lucerne
Pisum arvense	Field Pea (2)
B. *Grasses*—	
Avena fatua	Black Oat (2)
A. sativa	Oat (2)
Bromus unioloides	Prairie Grass (2)
Lolium perenne	Perennial Rye-grass (3)
Setaria italica	Millets (15)
S. viridis	Pigeon Grass (2)
C. *Other Weeds*—	
Brassica napus	Rape
Brassica nigra	Black Mustard
Chenopodium album	Mexican Spinach
*Datura stramonium	Thorn Apple
Malva rotundifolia	Mallow (7)
Petroselinum sativum	Parsley
Rumex spp.	Docks (2)
*Xanthium spinosum	Bathurst Burr (4)
ii. Panicum miliaceum	French Millet
Containing :—	
A. *Grasses*—	
Andropogon sorghum	Sorghum
Setaria italica	Millets (5)
B. *Other Weeds*—	
Fagopyrum esculentum	Buckwheat
*Polygonum convolvulus	Black Bindweed
iii. Phalaris canariensis	Canary Grass
Containing :—	
A. *Grasses*—	
Avena sativa	Oat (2)
Bromus maximus	Large Brome Grass
Lolium temulentum	Drake (3)
Panicum miliaceum	French Millet
Triticum sativum	Wheat
B. *Other Weeds*—	
Amaranthus retroflexus	Pigweed
Brassica arvensis	Wild Mustard
Brassica nigra	Black Mustard (2)
*Centaurea cyaneus	Star Thistle
Chrysanthemum sp.	Ox-eye Daisy
*Convolvulus arvensis	Lesser Bindweed (2)
*Galium aparine	Cleavers (2)
Linum usitatissimum	Linseed
Rumex spp.	Docks (3)
*Raphanus raphanistrum	Wild Radish

Scientific Name.	Common Name.
iv. Avena sativa	Oat
Containing :—	
A. *Legumes*—	
Trifolium agrarium	Hop Clover (2)
B. *Grasses*—	
Avena fatua	Black Oat (5)
A. sterilis	False Wild Oat (3)
Hordeum vulgare	Barley (13)
Lolium subulutum	Wimmera Rye-grass (4)
L. temulentum	Drake (2)
Triticum sativum	Wheat (7)
C. *Other Weeds*—	
Brassica nigra	Black Mustard (6)
*B. sinapistrum	Charlock (2)
Lychnis alba	White Campion (2)
*Polygonum convolvulus	Black Bindweed (4)
Rumex spp.	Docks (5)
Scandix Pecten-Veneris	Shepherd's Needle (2)
Scabiosa arvensis	Field Scabious (2)
v. Holcus lanatus	Yorkshire Fog
Containing :—	
A. *Legumes*—	
Trifolium dubium	Suckling Clover (2)
T. repens	White Clover
B. *Grasses*—	
Agropyrum repens	Quack Grass
*Bromus secalinus	Cheat or Chess
Cynosurus cristatus	Crested Dogstail
Lolium multiflorum	Italian Ryegrass
L. perenne	Perennial Rye-grass
Phleum pratense	Timothy
C. *Other Weeds*—	
Myosotis sp.	Forget-me-not
Plantago lanceolat	Rib Grass
Ranunculus repens	Creeping Buttercup
Rumex acetosella	Sorrel

* Noxious weeds under the Agricultural Seed Act, 1923.

(To be continued).

BREEDERS OF TAMWORTH-BERKSHIRE BREEDING SOWS.

Numerous inquiries are being received at the Department of Agriculture from farmers desirous of purchasing sows produced by mating pure bred Tamworth and pure bred Berkshire parents, as to where such stock may be obtained. The following list of farmers who are breeding these desirable first cross sows is, therefore, supplied, and will be supplemented from time to time as the information becomes available:—E. A. Ryan, "Fairfields," Pingrup; J. & S. F. Vaux, Ongerup; L. W. Barrows, Ballidu; G. M. Webb, Kojonup; H. Noon, Katterup; Hillier & Monti, Karridale; Manager, Sanatorium Farm, Wooroloo; Manager, Stud Farm, Denmark; D. T. Bantock, Wanneroo; W. G. Burges, "Tipperary," Burges' Siding; A. G. Oliver, Wickepin.

COMB HONEY PRODUCTION.

In the production of comb honey, there are three important factors to be taken into consideration. First, there must be a honey flow on. Second, bees must be strong and bubbling over. Third, the strain of bees must be such as will work in the small square boxes.

Definition.—When comb honey is spoken of, it is usually intended to mean honey in the comb in small boxes, usually about 1 pound just as it comes from the hive. These boxes are called sections and are made to fit either "Ideal" or half depth supers. It is also referred to as section honey, which is probably the better name of the two. The large frames such as Langstroth, Ideal and half depth are usually spoken of as combs of honey, and are not a standard on the market in the way that sections of comb honey are.

Beginner's Luck.—Many beginners, when starting beekeeping, are anxious to produce sections of honey; they have no extractor and want honey in the comb for the table. The first thing done after obtaining a hive is to put on a queen excluder and a box of sections. More often than not, they are greatly disappointed; the bees swarm without having done any work in the sections; the sections are left on all the season and yet there is little or no honey therein. The beginner says there is no honey in his district and it is no good for bees.

Of course there are exceptions to this. If the beginner is fortunate in obtaining a really strong hive and putting the sections on just as the honey flow starts, all is then well and he is keen to continue, and may later become a successful beekeeper.

First.—To obtain good sections, there must be a good honey flow. By this is meant that there are a large number of flowers in blossom containing nectar so that the bees are able to store honey very rapidly.

There is so much honey to be obtained, and the bees are so anxious to secure a store of it, that they will utilise every available space in the hive.

In the spring, when breeding is taking place, the brood require such a large quantity of honey and pollen, that very little surplus is stored, but when the hive is full of bees, and there are millions of attractive cups containing the "Nectar of the Gods," our industrious little friends will toil from dawn to dusk to fill every corner of their larder, and the sections are quickly filled and beautifully capped.

But when the honey flow is poor or intermittent, honey is brought in so slowly and irregularly that the sections are poorly filled, badly capped, and travel stained.

Sections should not be placed on the hive until there is promise of a good flow of honey, or they are liable to be spoilt by irregular work and discoloration, before the real work begins. It is necessary, therefore, for the beekeeper to know something of the flora of his district and when to expect the honey crop.

Second.—Bees must be strong and bubbling over. By this we mean that as soon as the cover of the hive is removed the bees come pouring out from between the combs, the tops of all the frames being almost immediately covered with bees, which then begin pouring over the sides of the hive.

When a hive is in this condition, it is ready to receive sections for comb honey. But very often, it is also ready to swarm, and of course, if this occurs,

there will not be sufficient bees left to fill the sections, which will be neglected until the hive is again full of bees.

It must also be remembered that it is necessary to have bees of the right age, that is field bees, old enough to go out and gather the available nectar. Very few bees become field bees under two weeks old. It is, therefore, necessary that the eggs that produce the field bees for the expected harvest should be laid five or six weeks before it commences.

In selecting colonies for section honey production, it is important to select those that have come through the winter strong and that have a young, vigorous queen. If few of these are available, it will be best to unite two of medium strength.

As stated above the beekeeper must first learn when to expect the honey flow, then about two months before this he must begin to get his hives ready to take advantage of it.

Now, having realised that what is required is a hive boiling over with bees of the right age, and yet not desiring to swarm, we have the difficult problem of how to obtain this.

A method of obtaining a large number of bees, when working for extracted honey, is the Demaree method. The principle of this being raising the brood above a queen excluder leaving the queen on say one frame of brood below, the rest being empty combs, so that the queen has plenty of room to lay, the young bees hatching out above the excluder. In some cases the empty combs for extracted honey are placed above the brood while in others they are placed between the brood and the excluder. This principle is also useful in working for comb honey.

Having selected a suitable colony with a strong vigorous queen give her plenty of room and induce her to fill as many storeys as possible. The hive should then contain a large number of wax workers as well as field bees. When this has been obtained, one method is to take away all surplus storeys, crowding the bees and brood into one or two storeys, and if there is too much brood, taking some away, of course, making sure that there are no queen cells left, then placing the box of sections on top and as soon as the middle sections have been drawn out, filled, and capping started, raise the box and place another empty one underneath.

Another method after the Demaree plan is that adopted by S. Cushman of the United States of America. He says—"I insert the first comb honey super over the lower brood chamber (full of brood and having a queen) with a queen excluder between. Over this, first one or two supers are placed, then above these another lot of brood belonging to this colony or from another colony. The supers are then tiered up between these lots of brood until enough have been drawn out to avoid crowding the breeding space below, when the conditions are practically the same as in the hive run for extracted honey. Thus we give our comb-honey colonies more brood from other colonies if necessary, instead of taking any away."

There are several objections to this method, one being that the bees are liable to store honey in the top brood chamber as fast as the brood hatches. This, however, might be overcome by keeping this top chamber supplied with full brood combs from other hives, and later removing it altogether, also any supers of shallow frames, leaving only the section boxes.

Discussing the question of comb honey productions Cushman says—"Can we manage a comb honey colony so as to employ in the hive through the season all the bees it can produce, prevent any swarms issuing, avoid any desire to swarm,

and give more and more comb builders than they can produce themselves? That is instead of robbing them of their comb builders, give them an unlimited number at will."

In dealing with two medium strength colonies, the following method may be adopted. First place the two hives close together a few days before operating, then from one hive remove all uncapped brood and stores, leaving all bees and capped brood in the brood chamber.

From the other hive, take all frames of capped brood without bees, and put them into the first hive, which will now contain only the queen, bees, and capped brood. If there are not sufficient frames of brood, the space may be filled temporarily with frame dummies. Place a comb honey super on top of this. The uncapped brood and honey from No. 1 may be placed in No. 2, which should then be moved away, so that its flying bees may join No. 1, when returning.

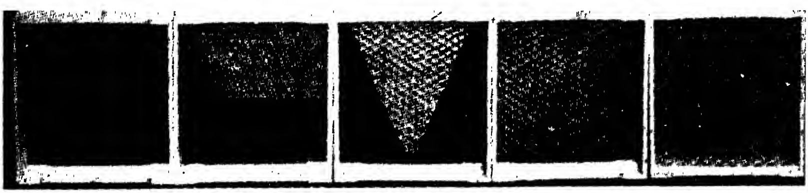
The first hive will now have very little room in the brood chamber to store honey, but empty cells will be provided for the queen to lay in as the brood emerges. Above in the section box there will be room for the comb builders and honey gatherers, who will be forced up into this on account of there being no space for them to work in, in the brood chamber.

Whatever method is adopted it must be borne in mind that the object of the beekeeper is to have plenty of bees, both of the comb building and the fielding age, crowded into the section supers. At the same time the brood chamber must not be so crowded as to give the bees a desire to swarm.

In the *third* place, a suitable strain of bees must be selected. There is always a good market for well filled, clean sections with white cappings. It is generally considered that Italian bees do not produce such white cappings as the blacks or hybrids, but this is not an infallible rule; some strains of pure Italians will produce good white cappings. In selecting a colony for comb honey it should, therefore, be noted how the bees usually cap their honey.

Carniolan bees are noted for their white capping, and are, therefore, particularly suitable for producing comb honey. Some of the finest selections I have seen were produced by Carni—Italian cross at Mr. Hall's apiary at Manjimup.

It will be found that some colonies take to sections much better than others, and it may be found advisable to discard some colonies from comb honey production and keep them for extracted honey.



Preparation of Sections.—All sections must be prepared with foundation or small pieces of drawn comb. It is always advisable to have a few sections in the centre of the crate fitted with small pieces of drawn comb, which may be fixed with a little melted wax; or better still, incompleted sections left over from last season.

There are several methods of using the foundation as illustrated but that which is generally most satisfactory is the full sheet, or the large sheet at the top with a space of about ¼ inch between it and the narrow strip at the bottom. Either of these methods usually produces well drawn out sections fixed to the bottom of the box.

The section box usually used is the one piece section folded at the corners after damping; some are quite plain and the foundation is fixed with melted wax, others have a slot cut which grips the foundation when folded. The sections are then placed in section holders or carriers which are placed in the super with separators, of which there are various types, inserted between them. The object of the separators being the prevent the bees building burr comb between the sections.

A method recently described by Mr. F. R. Beuhne to induce the bees to enter and start the sections is as follows:—

Remove a section holder from the shallow super and stand the latter aside, then take a comb of brood from the centre of the bottom box, attach to the bottom bar of the frame a piece of board the size of a shallow frame (without the projecting lugs), then replace the section super on the hive, and hang the brood comb, with board attached into it. This will expose some of the brood in the section super, and the bees will at once crowd up and build comb in the section alongside the brood. When comb building is well under way the brood comb is removed, the board detached from it, and the frame put back into the brood chamber. It is necessary to attach to the frame the piece of board mentioned when it is first hung through the half super to prevent the bees building comb into the space below the raised frame.

By means of this method, bees can be induced to work in sections when otherwise they would sulk or swarm.

THE PEANUT.

(*Arachis hypogea.*)

ITS CULTIVATION IN WESTERN AUSTRALIA.

F. J. S. WISE,
Adviser in Tropical Agriculture.

Never, in this State, was the time more opportune for an expansion of the peanut growing industry than the present. This is due to the fact that the price of first-quality peanuts is £84 per ton, largely because the Australian grower is assisted with a tariff of 4d. per lb. for peanuts in the shell and 6d. per lb. for the thrashed kernels. In this respect the American grower, who is able to compete successfully with Chinese grown nuts, is not assisted to anything like the same extent. The relative tariffs are as follows:—

Peanuts in the shell—
American—£1 14s. 6d. per ton.
Australian—£37 6s. 8d. per ton.

Kernels—
American—£3 9s. 0d. per ton.
Australian—£56 0s. 0d. per ton.

Nuts are graded into—(1) Confectionery, (2) Roasting, and (3) Milling. Among the uses of the oil obtained from milling the nuts are finest, for salads, oil, medicinal purposes, and as a high speed lubricant; first quality, for cooking and for the manufacture of margarine; the lower grades for soap making and other industrial purposes.

Ten years ago the Commonwealth imported 4,000 tons of nuts and 56,000 gallons of oil worth £36,000; last year the total importations of peanuts and peanut products exceeded £20,000 in spite of the heavy tariff. France alone manufactures 40,000,000 gallons annually from imported nuts. America has 120,000 growers producing 600,000 tons of nuts annually.

The Bureau of Agriculture at Washington states that peanuts give a higher monetary return than any other crop in the Southern States.

Where conditions of soil, rainfall and climate suit the production of this crop, and where transportation is not a prohibitive item, we have a certain local market to satisfy, with, at present, little danger of over production. Where conditions suit, it is a farm crop of considerable economic importance, for the plant being a legume it is a most desirable crop for soil renovating or improvement, as well as being a highly nutritious fodder.

DESCRIPTION.

The peanut (*Arachis hypogea*), also frequently known as the earth nut, is a plant belonging to the natural order Leguminosae, which are podbearers, and in common with most other members of the family has the power to obtain its nitrogen supply from the air. Its rootlets contain nodules or tubercles of various sizes, and these nodules contain millions of organisms which have the power to collect free nitrogen, and storing it within the tubercle it is rendered available to the plant and supplements the nitrogen from the soil.

Unlike other legumes, this plant, while blooming above the ground, matures its fruit or pods under the surface of the soil.

The yellow and sometimes pink flowers are borne at the joints of the stem in the case of the bunch varieties, at the base of the plant; in the creeper or procumbent varieties, right along the stems. When pollination takes place the flower fades and falls off, leaving the stem with a thickened pointed end, called the "point" or "peg," which grows down into the soil, where it matures the pod or so-called nut.

CLIMATE.

Although considered a crop for tropical countries and latitudes, the peanut will thrive under a wide range of climatic conditions, in fact, the world's crops are produced in sub-tropical zones. While in the cooler parts of this State it would succeed only in the summer, in the tropical portions it may be grown at any period where a sufficiency of rain falls. Ideal climatic conditions would be an early spring, comparatively high temperature, a moderate rainfall, plenty of sunshine, and a dry autumn or harvesting period that a minimum of loss would be occasioned through weathering and discolouration of the shells. The crop is very susceptible to frost, and a climate with freedom from frost for at least five months of the year is necessary. Departures from these conditions will result in a more lengthened period of growth. The crop can also be grown under irrigation, and it is very possible that as a rotation for the tomato growers of Geraldton and Carnarvon no better selection could be made.

PERIOD OF GROWTH.

The period of growth varies according to the variety and the climate, the upright or bunch varieties usually occupying fifteen to sixteen weeks, and the creeper or procumbent sorts from eighteen to twenty-two weeks to reach maturity.

SOILS.

The nature of the soil and its fertility is the greatest factor in a profitable crop. A sandy loam, of good lime content and reasonably rich in humus, may be regarded as ideal. A heavy soil, though kept in a friable condition and producing heavy crops, often causes great losses at harvest times owing to the difficulty in releasing the nuts from the soil. It is apparent from the brief description of the manner in which the nuts form that a loose surface texture is very desirable to allow the pegs to penetrate the soil and expend to form the pods, to mature evenly, and to permit of easy harvesting. Good drainage is very essential. The clean bright shell, produced in a sandy loam, being more inviting than stained shells from heavy soils even though the kernels are of no better quality, will naturally command a better price.

Preparation of the Soil.—In preparing the land for peanuts, if the soil is a free loam, the first ploughing should be deep, without bringing up any subsoil, and the second should not be more than five inches. This surface five inches should be brought to the best state of tilth possible, and kept well cultivated until ready for planting.

VARIETIES.

The best varieties are the large white shelled creeper sorts, being much more in demand for both confections and for margarine. The best commercial nut in Australia at the moment is the large white, imported a few years ago from Rhodesia, and which is now available at Darwin and through the usual seed merchants. The bunch varieties of Virginia (notably the Virginian Red Cross and Florida Bunch) are excellent croppers, and for a trade where a smaller nut is not objected to, can be highly recommended. Where it is desired to save the tops for fodder, the upright growers are the best.

SELECTION OF SEED.

Only best and sound kernels should be planted, and in common with other crops poor seed cannot be expected to give a good return. When selecting own seed, select heavy yielders or even maturity, and allow the nuts to remain on the plants for several weeks after curing. A special seed patch is desirable, selecting only the best, picked over by hand, and thoroughly dried and stored against weevil attack. Benzine drums are most satisfactory for seed storage.

METHODS AND TIME OF PLANTING.

According to the climates of the various districts, so must the time of planting vary.

In cooler districts plantings may be made as soon as all danger of frosts is over, and when the soil is getting warmer. In the tropics the crop can be grown at any period to suit the most certain rainfall months, perhaps late January and February would suit best, as long as sufficient rain can be depended upon to mature the crop and fine weather be expected at harvesting time. If large areas

are to be planted it is advisable to consider the area it is possible to handle daily at harvest time, and arrange successive plantings accordingly. Peanuts allowed to remain in the ground after maturity are easily detached from the plants, and in consequence a large number are not gathered, and there is also the danger of sprouting.

The seed can be planted either whole or shelled. Some growers favour soaking whole nuts to accelerate germination, but experience has proved that shelled seed is a distinct advantage. With shelled seed there is no danger of "duds" being planted, consequently a more even patch and crop results.

The seed may also be planted with a special plate in an ordinary planter, and in addition germination is more even and takes place days earlier. With shelled nuts germination takes about five days.

Quantity of Seed.—To sow an acre the amount of seed required is about 40 pounds of the whole nuts and from 20 to 30 pounds of shelled nuts, varying according to the weight of the nut and the spacing adopted in planting. Some growers use as much as 60 pounds per acre of the large podded varieties.

Planting may be done with a combined drill, or by hand. If by hand, drills should be run out 36 to 48 inches apart, according to the cultivating implement to be used. Upright varieties may be planted closer. The seed to be dropped: bunch varieties eight to 12 inches apart in the row, and creeper varieties 10 to 20 inches. The seed should not be covered more than 1½ to 3 inches, according to the condition of the soil and the moisture present. Where planting is done by hand, cover with a light harrow.

Fertilisers.—Where necessary and desirable to use fertilisers, very little nitrogen is necessary. In common with all legumes, peanuts thrive best where there is a sufficiency of lime. Even where the lime content is good, in soils which give a slight acid reaction, the application of half a ton of burnt lime or one ton of ground limestone broadcasted and harrowed (not ploughed) in will be very beneficial, preferably applied a few weeks before planting.

Of commercial fertilisers, one with a formula of 0-14-8 or 2-12-6 in quantities of not more than six cwt. per acre, or the following mixture per acre:—2 cwt. superphosphate, 1 cwt. sulphate of potash, 1 cwt. meatworks manure is best.

If any organic manure is applied it should be well rotted, and then only in small quantities. Fresh organic manures will cause the pods to be poorly filled, and will increase the "duds."

Apply the fertiliser lightly along the drill by hand or very close to the rows, as the peanut roots cover a narrow radius.

CULTIVATION.

Thorough and frequent cultivation is advisable. Early cultivation with narrow tines and with the cultivator close up to the plants, but after the plants have spread, and especially after flowering they should not be disturbed, and inter-row cultivation should then be confined to the centre of the rows. Slight hilling is best practised during each cultivation to permit the "pegs" to easily enter the soil, but on no account should the earth be thrown into the centre of the plant. After-cultivation with broad tines ordinary hilling attachments will form a fine

surface mulch for the nuts to form in. Where being grown under irrigation, inter-row cultivation between weekly and fortnightly waterings is essential. Watering should on no account be continued later than four weeks after flowering. Constant cultivation will then give best results.

YIELD.

Though phenomenal yields of three tons per acre have been recorded in Australia, a yield of 15 cwt. may be taken as a fair average yield.

DROUGHT RESISTANCE.

This crop has the ability to withstand severe dry weather conditions when well established, and on the other hand, provided the land is well drained, will stand up to excessive rains.

HARVESTING.

When the normal period of maturity has been reached the plants will assume a yellowish colour, and on examination the majority of the nuts will be found to be fully grown, and the inside of the shell will show darkened veins. The crop is then ready to lift. Too early harvesting will result in a high percentage of empty shells and shrivelled kernels. On the other hand, if the crop is left too long, a big proportion of the crop will be left in the ground, and in the case of fodder, from the tops many of the leaves will have fallen. In friable soils the plants are readily lifted by hand, in heavy soils the assistance of digging forks or of a suitable digger with finger bars instead of a mouldboard, must be sought.

After lifting the plant and shaking the soil from the nuts, the plants should be left lying in small bunches until the leaves are well wilted, but not brittle. This is usually only a matter of a few hours if the weather is favourable. They should then be gathered into larger stacks in the field, if the acreage is large, stacking around suitable poles with cross pieces attached, is the best method. With open stacking, the best method is to pile in the form of a hollow circle, with nuts inward, and if not stacked too closely the circulation of the air dries the nuts, and at the same time the tops are cured. After two or three weeks in the paddock they may be safely stored in the barn, *but it is advisable to allow curing and maturing to continue for at least another month.* Nuts picked from the vines too soon are not thoroughly matured, and in consequence the kernels are shrivelled.

Hand picking has been the main system in vogue through the ages, and is still the only system practised in China, India, and Japan.

Excellent machines for all stages of the industry are manufactured in America. Two types of American machines for threshing or picking the nuts from the vine have been imported into the Eastern States, one working on the principle of a cylinder grain thresher, the other, one in which the plants are passed over a conveyor and drawn between spring points over a wire mesh, causing the nuts to fall on to a belt which conveys them to the winnower and grader. Several machines of the latter type are being successfully used in Queensland, and they have the advantage of being on wheels, and are drawn from farm to farm.

For hand picking or threshing the best plan is to beat the nuts across a board or tightly drawn wires in the case of the bunch nuts, and with creeper nuts

to rub the whole plant through fine mesh wire netting, tightly drawn over a box, when subsequent winnowing will remove trash and light shells. The leaves and light pods form an excellent forage.

MARKETING.

The nuts are usually bagged whole for shipment to the buyer. Breaking of shells and bruising of kernels should be avoided, as decomposition soon sets in with damaged nuts, and weevils are more likely to become a pest. Where shelled kernels are marketed great care should be exercised, and they should be kept absolutely dry.

PESTS AND DISEASES.

Insect pests are not of frequent occurrence, though grasshoppers at times cause damage, and mealy bugs have also been found on occasional roots.

The most common disease is a form of leaf spot (*Cercospera Sp.*), which appears as a brownish spot, and is usually found where conditions of bad drainage prevail. In the main it may be said that the most common troubles met with in this crop are due to conditions and not diseases, and caused through unsuitable soils or locations.

A NEW FRUIT FLY LURE—PRELIMINARY REPORT.

L. J. NEWMAN.
Entomologist.

In continuance of our search for more effective lures for the capture and control of the Mediterranean Fruit Fly, many experiments have been made.

The preparation which has given excellent results is the proprietary article known under the trade name of "Clensel." This had been previously used as a successful contact spray for other insects. It has a very pronounced appeal to the olfactory senses of this particular fruit fly, proving an irresistible lure. Up to the making of this discovery, the departmental pollard and borax lure had given the best results.

The experiments were commenced in May and have been continued throughout the wet season to the end of August. The tests are to be continued for a period of 12 months, when the final results will be published. It has undoubtedly proved a successful winter trapping medium, but how it will act as a summer lure during the hotter dry weather, and in face of the counter odours of the various fruits in season has yet to be determined.

The odour given off when mixed with water is very pleasant and certainly proves attractive to the fruit fly. How it will appeal to other species of fruit fly can only be answered by testing. Fortunately, *Ceratitis capitata* is the only species with which we have to contend.

In the trials made, the pollard lure was used as a control.

The *modus operandi* was as follows:—Various strengths of "Clensel," ranging from 1 in 20 to 1 in 80 of water, were tried out. In each tree, two traps each of

"Clensel" and pollard lures were used, in citrus trees, being hung alternately. Every seven days the traps were examined and the total capture of fruit flies, males and females, recorded. The lures were renewed every seven days. The number of traps used in the experiment were 10 of "Clensel" and 10 of pollard and borax.

To date, the "Clensel" lure has given practically a 2½ times better capture of fruit flies than the pollard control. The figures for the period May to August were, "Clensel" 1,524 flies, pollard 604 flies. The strength at which this lure is recommended is 1 part to 30 parts of water. The lure should be renewed every 7-10 days. During this test, glass traps v. tins were tried out. The glass jars have shown a slight advantage over the tins. There are, however, other good reasons why glass jars are preferable to tins. The jars never rust, always retaining their bright appearance, which is a factor in luring the fruit flies. They are more easily cleaned. The third important factor in favour of their use is, that the operator can readily see, by looking through the glass, the results of his trapping efforts and thus becomes enthusiastic.

It will be observed that this capture of 2,128 fruit flies has been made during the winter months when most growers, in spite of repeated appeals, discontinue their efforts against this pest.

If the public would make greater efforts during the winter and spring to capture the over-wintering fruit flies, a very severe checking blow could be dealt this virile fly.

THE DOUBLE GEE

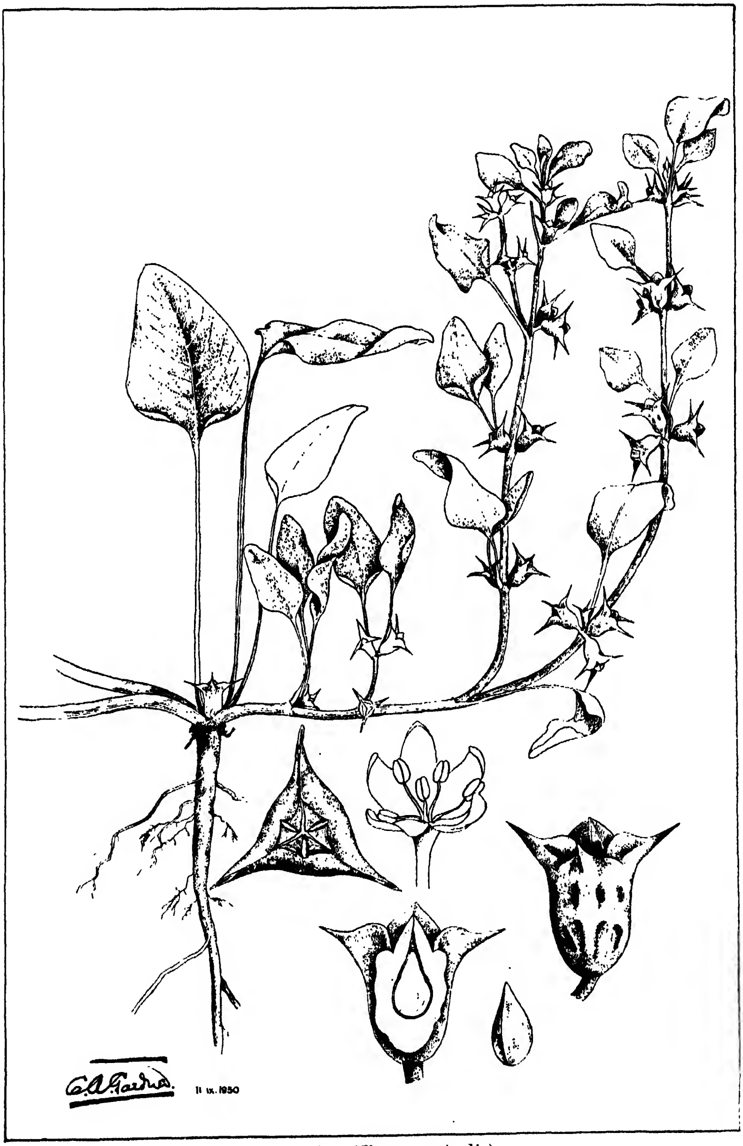
(*Emex australis*, Steinh.).

C. A. GARDNER,
Government Botanist.

Most people are familiar with this weed, common to many parts of Australia. Its characteristic three-spined fruits adhere to or penetrate most things with which they come into contact, and they are so hard and rigid that they enter with ease the hardest skin. The name is derived from Dubbeltge—Doorn, an Afrikaan name meaning Devil's thorn. The plant is also sometimes known here as Cape Spinach, because it was introduced from Cape Colony, and when boiled as a spinach it is said to create an appetite, and is also mildly purgative and diuretic.

F. Turner, writing in the "Sydney Morning Herald" of 7th December, 1912, says: "In 1830 the ship "Margaret" left Bristol, England, with passengers for the Swan River Settlement, and during the voyage called at Capetown, South Africa, where one of the intending settlers procured some seeds of the so-called Cape Spinach, a plant known to botanists as *Emex australis*, with a view of cultivating it in the land of his adoption. In due course the seeds were sown in a garden and the resulting plants grew vigorously, but, instead of being a useful vegetable it has proved to be one of the most obnoxious and aggressive weed pests ever acclimatised in Australia." The plant spread mostly in the coastal areas towards Champion Bay. As the Murchison and Gascoyne areas were settled the stock introduced the seeds of this pest, and now it is to be found in all of our pastoral areas from the Kimberleys southwards. Stock serve as the principal agents in the dispersal of the weed, but rubber-tyred vehicles are also an important means by which the plant is carried into new districts.

The Double Gee is now known from all the Australian States. For many years (until about 1870) it was confined to Western Australia, but it then appeared in South Australia where it became known as "Prickly Jack." From there it spread



Double Gee (*Emex australis*).

into Victoria and New South Wales at a later date, being known as "Three-cornered Jack" or "Cat's Head." Later still J. F. Bailey recorded it from Queensland in 1911. At the present time the weed is a declared noxious weed in the Gingin,

Toodyay, Wickepin and Yilgarn Road Board areas, and in the Broome Ward of the Broome Roads District.

The seeds of this plant rarely if ever detach themselves from the spiny fruits. These fruits are only carried by some animal or mechanical agency, so that plants are only likely to appear in districts where the weed is unknown through the agency of introduced stock. The plant being an annual can be controlled providing it is eradicated before it is allowed to seed, and since this may occur at an early stage of its growth, the plants should be destroyed upon sight by cutting through the tap-root just below the crown, *i.e.*, an inch or two below the soil level. A hoe is useful in this respect, and in the Murchison district where the seriousness of the weed is more apparent than elsewhere, good results have been obtained by individual efforts, squatters carrying around with them small hoes like walking sticks, with which they cut off every plant seen. The plants will germinate freely after winter, spring or summer rains. Once established the plant is very hardy, and does not die off until it has seeded. It is of course most important that the eradication of the weed should be carried out as soon as the plant is recognised, since it may spread to an alarming extent in the course of a year or two if unchecked.

Description of Plant.

A vigorous spreading glabrous annual with rather fleshy prostrate or ascending stems radiating in all directions. Taproot long and thick. Leaves mainly ovate or ovate-triangular, sub-cordate or truncate at the base; the basal leaves usually the largest on long leaf-stalks, the upper ones gradually smaller, or with shorter leaf-stalks. The flowers are of distinct sexes. The males, consisting of a 5-6-lobed perianth and 4-6 stamens, are borne in oblong racemes in the upper leaf axils, often with a few females at the base. The females are usually congregated in the leaf-axils, and are almost sessile. The female perianth consists of six segments of which the outer three develop into the spines of the fruit, the inner three remaining erect and connivent in a pyramid at the summit of the fruit. The fruit is hard and very durable; when shed it lies on the soil with one spine uppermost. It contains one seed which is 3-angled, and rarely, if ever, shed from the fruit. For further particulars see plate.

COMBINED SPRAY FOR THE DESTRUCTION OF THE CLOVER SPRINGTAIL (LUCERNE FLEA) (*Smynthuris viridis*), AND THE RED-LEGGED EARTH MITE (*Penthaleus destructor*).

By L. J. NEWMAN,
Entomologist.

During the past winter a series of spraying experiments have been made with the view of discovering a cheap and effective spray for the dual purpose of destroying the two above-mentioned pests.

In a great proportion of instances both the Springtail and the Mite are found in association, the exception being our sandy coastal lands and the drier inland areas which are not suitable to the propagation of the Springtail. The Mite appears to flourish upon light or heavy lands as long as the weather remains showery and cool.

Several proprietary sprays were tested, but although effective killers, were too expensive to use over large areas. The great difficulty in the control of these pasture pests is not what will kill them, but what it will cost to accomplish this purpose.

It has been proved by experiments that lime and sulphurwash is very effective against the Springtail at a strength of 1 part of concentrated spray to 50 parts of water. This, however, did not have any great checking effect upon the Red-Legged Earth Mite. Unless a combined spray could be used, it meant that two separate applications had to be made to any area infested with both pests. To this end we have demonstrated that the following mixture is effective and is economically possible of application to large areas:—

Lime and sulphur concentrated, 5 gallons; Izal, 1 gallon; water, 250 gallons. For smaller lots take 1 pint of Izal, 5 pints of lime sulphur and mix together in 31 gallons of water.

For the Springtail only, use 1 part of lime sulphur wash to 50 parts of water.

The Izal readily mixes with the lime sulphur.

In practice it was found that 60 gallons of the spray was sufficient for an acre of early pasture, the amount necessary increasing as the season advanced and the weed growth increased. The cost of the material works out at slightly less than one penny per gallon, or roughly 5s. per acre.

There is every reason to believe that the application of this spray some time in May, after the Springtails and Mites have made their first appearance, that great destruction of these serious clover pests would follow. If left later, the growth of weeds and grass render the work more difficult.

An important point in connection with the use of this spray is the fact that it is non-poisonous. Cattle and sheep will readily feed over pasture sprayed with lime sulphur, but when the Izal is added, they do not relish the feed for two or three days.

MARKET REPORT.

Messrs. H. J. Wigmore and Co., Ltd., of Wellington Street, Perth, have supplied us with the following information regarding Chaff available at the Metropolitan Chaff and Grain Auction Sales held in Perth for the period June to August (inclusive). In all cases the price quoted is for f.a.q. to prime Wheaten Chaff, packed in new bags.

	Quantity.	Maximum.	Minimum.
June	1,050 tons	£5 5 0	£5 0 0
July	990 tons	£5 5 0	£4 10 0
August	1,060 tons	£4 10 0	£4 5 0

The period under review has been very disappointing from a grower's standpoint; quantities under f.a.q. to prime have been very difficult to quit at reasonable prices. At the time of going to press the market value for f.a.q. to prime is from £4 5s. to £4 7s. 6d., f.a.q. from £3 15s. to £3 17s. 6d., and in some cases this quality is selling at £3 12s. 6d. Mediums are in very poor request at as low as from £3 5s. to £3 7s. 6d., damaged and inferior down as low as £3 per ton.

Oaten Chaff.—During the past three months heavy supplies were available and low prices had to be accepted. During June and July f.a.q. was selling at

£4 5s. to £4 15s., and during August this quality was realising from £4 to £4 2s. 6d. per ton. At the time of going to press f.a.q. is selling at from £3 17s. 6d. to £4, medium qualities at from £3 5s. to £3 10s. per ton.

Oats.—The market has been over-supplied, and with a lesser demand auctioneers have been forced to quit consignments at very low rates, the under-mentioned being the closing quotations:—

June and July—

Good heavy feed Algerian or Guyras—2s. 2d. to 2s. 3d. per bushel.
Medium feeds—1s. 9d. to 1s. 10d. per bushel.

August—

Good heavy feed Algerian or Guyras—1s. 9d. to 1s. 10d. per bushel.
Medium feeds—1s. 5d. to 1s. 6d. per bushel.

Wheat.—During the months of June and July f.a.q. was realising from 4s. 3d. to 4s. 8d. per bushel, but during August the market eased in sympathy with overseas prices, f.a.q. selling at auction at from 3s. 10d. to 4s. 2½d. At the time of going to press, however, the market has eased still further, f.a.q. selling at from 3s. 3½d. to 3s. 6d., quality approaching this at from 3s. 1d. to 3s. 2d., second grade at from 2s. 11d. to 3s., cracked grain selling at from 2s. 9d. to 2s. 10d. per bushel, smutty and inferior at lower prices according to sample.

LIVE STOCK AND MEAT.

For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder, Smith & Co., Limited, Perth:—

COMPARATIVE YARDINGS OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS, FOR MONTHS OF JUNE, JULY, AND AUGUST, 1930.

	June.				July.					August.			
	4th.	11th.	18th.	25th.	2nd.	9th.	16th.	23rd.	30th.	6th.	13th.	20th.	27th.
Sheep ...	10,820	9,479	10,447	9,948	13,209	12,872	15,410	14,951	13,280	9,880	13,435	13,885	16,116
Cattle ...	820	760	809	760	885	773	682	592	571	819	813	612	940
Pigs ...	879	815	803	756	962	687	678	720	923	1,251	1,083	1,144	1,331

COMPARATIVE VALUES PER POUND.

	June.				July.					August.			
	4th.	11th.	18th.	25th.	2nd.	9th.	16th.	23rd.	30th.	6th.	13th.	20th.	27th.
	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.
Mutton	5	5½	5½	6	6	6	6	5	5	5½	5	5½	5
Beef ...	7	7¼	6	5½	6¼	6½	7	7½	6½	6¾	6½	6	5
Pork ...	8¾	9	9	9¾	9¼	9¼	9½	9½	9½	9	8½	8	7¾
Bacon ...	8¼	8	8	8	7¾	7½	7½	7½	7¾	7¾	7¾	7¾	7½

METEOROLOGICAL INFORMATION.

Stations.	Temperature.				Rainfall.		Temperature.				Rainfall.		Temperature.				Rainfall.	
	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	JUNE, 1930.						JULY, 1930.						AUGUST, 1930.					
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	68·4	73·2	53·8	48·5	9·15	4·18	65·3	71·6	47·3	40·3	4·60	3·97	67·4	77·0	46·9	39·2	1·59	2·68
Geraldton	70·3	77·0	59·6	54·2	9·37	4·76	67·9	74·2	52·9	40·4	3·86	3·90	68·9	76·2	53·4	41·2	1·57	2·88
Walebing	64·5	69·0	51·1	43·0	7·95	3·98	62·8	70·0	42·7	36·0	4·61	3·72	63·4	74·7	46·8	54·6	3·71	3·02
Perth	66·3	71·4	54·0	48·0	11·35	6·96	63·9	69·9	48·6	41·0	10·17	6·64	63·8	72·4	49·7	4·10	4·89	5·73
Kalamunda	63·1	68·0	51·0	45·2	12·44	8·11	62·0	66·0	47·1	42·0	15·24	8·13	57·9	67·2	48·8	41·8	5·87	6·85
Bunbury	65·6	71·0	53·2	40·0	11·42	7·21	63·1	67·5	48·6	40·0	5·17	6·93	63·6	68·0	47·7	39·0	...	5·35
Bridgetown	63·6	71·0	47·3	36·0	9·43	5·82	61·1	67·2	40·8	32·2	7·02	5·77	62·2	70·0	41·2	28·8	3·33	5·10
Albany	64·4	71·8	50·9	45·0	3·23	5·51	62·4	69·0	46·5	39·0	6·12	5·54	62·6	71·0	47·0	41·0	3·96	5·19
Merredin State Farm	63·5	70·0	50·9	43·7	3·63	1·86	59·8	67·9	41·0	30·8	1·37	1·90	61·5	73·0	42·9	29·5	1·84	1·37
Northam	66·1	72·5	49·9	44·2	5·25	3·28	63·3	70·0	43·2	35·6	4·51	3·46	63·8	74·1	44·7	34·0	2·61	2·55
York	65·3	71·0	50·2	42·0	4·99	3·34	62·5	69·6	43·1	35·0	5·01	3·39	63·8	72·5	43·6	34·0	2·43	2·80
Narrogin State Farm	61·2	68·8	47·5	37·7	5·64	3·66	59·1	65·6	41·7	34·5	7·80	4·11	60·2	67·8	42·3	33·2	1·52	3·17
Katanning	61·0	68·1	49·0	37·0	5·75	2·88	58·5	65·1	44·3	37·3	4·31	3·05	60·4	67·4	44·8	37·0	1·02	2·48
Cape Leeuwin ...	63·9	70·0	55·5	48·8	8·61	6·85	61·6	67·0	53·0	44·0	8·17	7·25	61·4	69·0	52·5	44·0	3·97	5·28

PRODUCERS' MARKETS CO-OPERATIVE, LTD.

Report as under for quarter ending 10th September, 1930:—

Fruit was well supplied throughout with every variety in season. Tomatoes ex-Geraldton commenced in July with fair values, and have since increased in volume. Prices this year, in comparison with a similar period of last year, are very low. This is probably due to unfavourable weather and financial depression. Citrus growers commenced with fair values but excessive rain and wind caused the majority of their fruit to fall, and the market was consequently over supplied. During the last month, however, prices have improved, and growers still having navels to market should realise high values. Lemons remained unsettled throughout, but prime mandarins were always in demand. Apples have remained steady throughout; early Jonathans being well supplied with values firm. With the exception of a few prime lines values remained fair until the middle of August, when they dropped 2s. to 3s. on all varieties. The market for grapefruit has been exceptionally firm this season, prices realising up to 22s. 9d. per bushel case. Cape-gooseberries realised satisfactory prices, with passion fruit short supplied and selling to a good demand.

Vegetables.—Supplies at the beginning of the quarter were only fair, bunch lines being very short, but equal to the demand. Cabbage values were firm with good supplies forward. Country potatoes were forwarded to a weak demand, many badly graded lines being noticeable. Cauliflowers continued heavy, but the quality for the most part was poor, improving, however, towards the end of last month. Values for peas and beans were firm.

Eggs.—Early June saw increased supplies, which remained steady throughout the month with values unaltered. New-laid hen eggs selling at 1s. 7d. to 1s. 11d. Increasing supplies, however, caused prices to drop considerably, with the demand good.

Poultry.—At the beginning of the quarter the demand for prime quality was keen and values maintained. Early August saw values for turkeys slightly lower, but other lines remained unaltered. Prices are now firming for nearly every line, with the exception of turkeys.

Carcase Meat.—Early June good supplies with veal in demand. Towards the middle of July there was an improved demand for veal, and also pork on account of short offerings. Lamb also plentiful at late ruling rates.

WESTERN AUSTRALIA—DEPARTMENT OF AGRICULTURE.

LIST OF BULLETINS AVAILABLE FOR DISTRIBUTION.

No. 5.—*Fruit Drying.* J. F. Moody.
No. 20.—*The Pruning of Fruit Trees.* J. F. Moody. Price 2s. 6d.
No. 24.—*Hints to Stock Breeders* (revised). R. E. Weir.
No. 30.—*Descriptive Account of the Codlin Moth.* L. J. Newman.
No. 37.—*Conference of Producers,* 1910 *and* 1912.
No. 46.—*Fruit Packing and Marketing and Exporting of Fruit.* J. F. Moody and J. Ramage. Price 1s. 6d.
No. 49.—*The Feeding of Horses.* Professor Paterson and G. L. Sutton.
No. 57.—*Vermin Destruction.* A. Crawford.
No. 60.—*The Farmer's Clip.* J. J. Mahood.
No. 68.—*Flaying and Treatment of Hides.* R. E. Weir.
No. 72.—*The Potato: Its Cultivation, Pests and Diseases.* G. N. Lowe, L. J. Newman, D. A. Herbert.
No. 79.—*Sheep on the Wheat Farm and their Management in W.A.* H. McCallum.
No. 83.—*Horticulture and Viticulture.* A. Despeissis. Price 2s.
No. 87.—*Sheep Feeding Experiments: State Farm, Chapman,* 1920. G. L. Sutton and F. Vanzetti.
No. 88.—*Light Land: Conference.* G. L. Sutton.
No. 90.—*Stock Waters: Standard for Composition of.* E. A. Mann.
No. 91.—*Dairy Premises.* P. G. Hampshire.
No. 93.—*The Home Tanning of Sheep and other Skins.* H. Salt.
No. 96.—*Poison Plants of W.A.* D. A. Herbert.
No. 99.—*Australian White.* G. L. Sutton.
No. 101.—*Cotton Cultivation.* G. L. Sutton.
No. 103.—*Kerosene Method for Eradicating Zamia Palm.* G. K. Baron-Hay.
No. 105.—*Pedigree Selection of Seed.* G. L. Sutton.
No. 106.—*The Red Legged Velvet Earth Mite.* L. J. Newman.
No. 109.—*Rape.* G. L. Sutton.
No. 111.—*Standard Wheat Varieties.* G. L. Sutton and F. Vanzetti.
No. 112.—*Automatic Device for Eradication of Stickfast Flea.* G. Allman.
No. 113.—*Picked Pieces: Classification of Clip.*
No. 114.—*Blue Mould on Citrus Fruits.* W. M. Carne.
No. 115.—*The Value of Windmills for Pumping Water in W.A.* A. H. Scott.
No. 116.—*Spotted Wilt of Tomatoes.* W. M. Carne.
No. 117.—*Cream.* P. G. Hampshire.
No. 118.—*Pigs and Pig Raising.* P. G. Hampshire.
No. 122.—*Descriptive Account of the Fruit Fly.* L. J. Newman.
No. 149.—*Lucerne.* G. L. Sutton.
No. 192.—*Root Rot.* A. J. Despeissis.
No. 220.—*Irrigation and Drainage.* A. H. Scott.
No. 221.—*Soudan Grass.* G. L. Sutton.
No. 225.—*Subterranean Clover.* G. K. Baron-Hay.
No. 238.—*The first Australian Studmaster—His Flock.* G. L. Sutton. (Reprint from "Journal.")
No. 239.—*Field Experiments,* 1927—*Chapman.* I. Thomas. (Reprint from "Journal.")
No. 241.—*Field Experiments,* 1927—*Merredin.* Langfield (Reprint from "Journal.")
No. 242.—*Field Experiments,* 1927—*Avondale.* Wild and Bailey. (Reprint from "Journal.")
No. 243.—*Successful Codlin Moth Control in W.A.* G. W. Wickens. (Reprint from "Journal.")
No. 244.—*Fruit Fly—Trapping Experiments.* L J. Newman and G. W. Wickens. (Reprint from "Journal.")
No. 245.—*Leaf Rust of Stone Fruit.* W. M. Carne. (Reprint from "Journal.")
No. 246.—*Field Experiments—Wongan Farm.* I. Thomas. (Reprint from "Journal.")
No. 247.—*Red Clover.* G. K. Baron-Hay, C. A. Gardner, and A. B. Adams. (Reprint from "Journal.")
No. 248.—*Elephant Grass.* G. K. Baron-Hay and C. A. Gardner. (Reprint from "Journal.")
No. 249.—*Phosphate or Phosphoric Acid* G. L. Sutton. (Reprint from "Journal.")
No. 250.—*Sheep—Hand-feeding.* H. McCallum. (Reprint from "Journal.")

JOURNAL

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Department of Agriculture

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ON THE ART OF HELPING OURSELVES.

(The Editor.)

There is an old adage that runs something like this: "He who will not buy, cannot sell." Time has not altered the verity of the aphorism, but the mutability of custom has wrought numerous transformations in the methods of our exchange. Barter has long since given place to money: a symbol, representing wealth, designed to simplify mediums of exchange. Money has given place to a money market, and has become a complicated maze that represents not the wealth of a nation but the money value of its wealth; and that money value rises and falls according to the pressure of internal and external influences. Thus we find Australia to-day teeming with wealth of varied sorts, and pregnant with potential sources (delightful catch-phrase) of more wealth, with a meagre population unable to assimilate more than a small portion, and yet, in the midst of all this plenty, there abounds poverty and distress.

What is Wealth? It should be those things needed by a people for their sustenance and well being; the essentials which provide food and clothing and shelter with something over for little luxuries and sport and amusement; the right of education and the pursuit of knowledge and happiness. All these Australia has in abundance. There is more than enough in our crops and herds to supply provendor for all; wool to clothe our backs, and hides to shoe our feet; timber and iron and clay to house the families of the Commonwealth; fruit and wine and innumerable etceteras to minister to the taste and pleasure of the populace and help build up a strong, virile race. There are enough savants among us to carry on our high standard of education, and a soil and climate rich in fertility to provide for all while the adolescent still continue their studies. Assuredly we have wealth in that sense.

But again, what is Wealth? Is it an agglomeration of Bonds and Securities, stamped paper and minted coins of gold and silver and copper; articles that in themselves could not appease a passing hunger and, excepting perhaps the paper, could not raise the temperature of one shivering body?

There are in this World certain peoples who have cultivated and established an acquisitive faculty for this form of wealth, which, in itself, represents a man's honour and his promise to pay. Just how they manipulate the flow of this wealth so that it will gravitate to their coffers is not easy to comprehend—at least it is not easy to most of us. Yet they manage it, and so they become the Kings and the Captains of Commerce. They are not, as is often misrepresented, a barrel-bellied hang-jewelled, coterie of gourmands, uncomfortably enthroned on bags of bullion. For the most part they are hard working devisers entrusted with the earnings and savings of many who are dependent on them for provision against penury in their declining years, and who look to them to finance their businesses, their homes and their farms, and perhaps their sustenance. They spend much time and energy in designing flows into their reservoir, and directing trade and commerce so that the rake-off will add to their accumulations, and enable them to pay the interest their clients must have in return for their capital invested. Much of their method is based upon loans for development of trade and commerce.

Australia has in the past been a huge exporter of promises to pay. A lot matters for what these promises were made, but what matters most of all is that they ARE PROMISES, these nice pieces of stamped paper, and that they represent the Australian standard of honour ; and that standard must be maintained. Our promises were accepted as national, and that our national honour ranked high in the World's estimation is evidenced by the readiness wherewith loans were obtainable. We have had a good time spending our promises, and now we have to face the honourable if painful duty of redeeming them. The moral is that we must in future be sparing in our promises and in our acceptance of help from others. We must practise the virtues of self support.

In the past, this is what has happened :

We desired to carry out some great undertaking, so we asked for a loan of money values, and the Kings and the Captains of Commerce said " Go ahead. We will finance it." So far so good, if it were to be reproductive and we carried out the work with the financial assistance given us. But very often we did not. We said " All right, lend us £20,000,000, but don't bother to send it out to us, just spend about 80 per cent. of it amongst your own people and keep them employed making the things we will require for our undertaking. The balance we will want to pay a few workers out here." That suits the Kings and the Captains. It saves them sending the money and helps them to keep their own people in jobs so that their traders and manufacturers get all the rake-off and they send us the manufactured steel and iron and copper and such like. And then when the undertaking is finished we have not had to use our own iron and copper deposits, and we have not had to build big plants and furnaces and things. All that has been done for us and our own deposits are quite new and have never been touched at all. Then the time comes for us to pay back this money we never had, but spent in some other country through some other agent, to keep its people in comfortable employment. Of course we have our nice new iron deposits and copperfields, but we cannot pay them with those because they do not want them, seeing that they have their own. We might pay them in gold, but, alas, we have been in the habit of pouring our gold into those channels devised by the clever Kings and Captains, in order to pay for old loans. So we offer to pay with wheat and wool and hides and things, and as we have not gold we are permitted to send them, but are assured that there are a lot of folks who can supply those commodities, and they too have debts to redeem, and it is surprising how little value there is in our goods to-day. " However," they say, " You better send us all you have and we will see what we can arrange for you." And so to 'save face' we have to send away the wool and the wheat, and our workmen who were engaged on the big undertaking are out of a job, and

can't get the goods their fellow patriots produced for them because they have to be sent away to some one who places little value on them.

How are we to get out of it ? It is a pretty mess. We have got to pay our debts and feed our people and keep them clothed and sheltered. Let us start on the last proposition first. We can employ a lot of people making our own clothes and our own boots. I do not see why they should not be as good as the clothes and boots from elsewhere, but if they are inferior, then that is our fault, and we have to put up with it and wear them, and we will soon encourage manufacturers to produce the better and more attractive article. Many are doing it now. We could employ a lot of people developing our deposits and manufacturing steel and copper and other things essential to our big undertakings. It would be better to spend £20,000,000 of our own golden sovereigns in Western Australia erecting plants and factories. We would then still have the 20,000,000 sovereigns in the State and the factories as well : if we send the sovereigns away to buy material from elsewhere, when we have purchased we have lost the opportunity of establishing manufactories, we have lost the sovereigns, and have someone else's goods wearing out in our own State. This is the Royal Road to Poverty. Let the Kings and Captains of Commerce erect their factories on our own shores and employ our people in our State manufacturing for our requirements, and we will all be better off. We can then employ some of their surplus inhabitants if they cannot find work for them. We can raise sufficient food and clothing for all and we can pay their interest and wipe off the old debts. We cannot do it if we continue to borrow goods from them and not gold. 20,000,000 sovereigns circulating in this State would accomplish a tremendous amount of development and we would still have the gold; £20,000,000 worth of debit notes for work done by other people in other lands leaves us with nothing in our coffers and a heavy responsibility of paying back in goods which can be bought by our creditors from cheap labour and low standard of life countries.

Last year Western Australia imported £20,000,000 of goods, 50 per cent. of which were made in other parts of Australia. What we spent in Australia does not matter so much. We get some rebound from there and the goods are manunufactured under our conditions and according to our standard of life. What we purchase from elsewhere matters a lot, because it is money sent away to people who will not take our goods except at the price for which they can be obtained from cheap labour countries.

We must begin to practise the principle in our own State first. £5,000,000 was spent in other parts of the Commonwealth last year to buy goods that are in competition with our own manufacturers. Think of this ! £5,000,000 heedlessly sent away, which, spent here, in one year would give employment to 22,000 adult males at the basic wage. Yet we go on buying indiscriminately whatever goods are offered us. Let us take a few lines of the principal commodities imported from the Eastern States alone : Butter, 58 per cent. of our requirements ; Cheese, 99 per cent. ; Honey, 43 per cent. ; Confectionery, 54 per cent. ; Fruit, juices, 76 per cent. ; Jams, Jellies and Sauces, 89 per cent. ; Vinegar, 15 per cent. ; Jelly crystals, 78 per cent. ; Tobacco and Cigarettes, 90 per cent ; Boots and Shoes, 64 per cent. ; Bacon and Hams, 65 per cent. ; Knitted ware, 42 per cent. ; Blankets, 85 per cent. ; Rugs, 84 per cent. ; Paints, 10 per cent. ; Crockery and Porcelain, 78 per cent. ; Oatmeal and Wheatmeal, 65 per cent. ; Wine, 55 per cent. ; Furniture, 8 per cent. ; Wearing apparel, 82 per cent. ; Of course it is not only the loss of money that we have to deplore, but there is also the loss of the value of raw material in the State that cannot be developed because we take manufactured articles from other States and Countries. Of course if we do not sell we cannot buy, but the trouble is we have been borrowers and

buyers so long we have neglected the selling side of the business. We have to do a lot of selling to get balanced up. We want to be brotherly and trade with people, and when we buy (and we will always have to buy for we are not self-supporting in all things) we want to know what the seller is going to take from us in return in the way of our goods. If he can't take our goods we don't want his. It is not unfriendly to refuse a neighbour's wares if you have nothing to give him in return, and it is very unfriendly to take his goods if you can't see your way to pay for them. The more self-supporting we can become the less we will have to buy, and the more we can produce the cheaper we can dispose of our surplus. Remember the parting advice of Polonius to his son : "Neither a borrower nor a lender be, for loan oft loses both itself and friend and borrowing dulls the edge of husbandry."

Now having settled this to our satisfaction let us "go to it." Talk it over with your wife and your family, and then with your neighbour. Make it a New Year resolve when you go marketing to ask, "Are these West Australian Manufacture" ? After that ask for Australian, and then Empire manufacture, but insist on all locally made goods first. If this principle is followed you will see a lot less unemployed this time next year. We could find employment for all our population with a decent return for their labours if we would use our own raw material and make our requirements. Following the prejudiced, blundering methods of the past we have reached the position where we have borrowed and purchased ourselves into debt, so that we might throw a lot of our good citizens out of employment, leaving them to face Christmas on a mere sustenance pittance ; we have hunted our capital away into bonds instead of circulating to create trade and manufacture. We have got to pay the piper. Let us pay him and get rid of his jarring discords, and let us lay hold of a new melody that will lilt us along the road to harmony and prosperity.

LUCERNE—THE QUEEN OF FODDER CROPS.

Geo. L. Sutton,
Director of Agriculture.

It is fitting that "Lucerne," or "Alfalfa," because of its particular suitability for the nourishment of young stock of all kinds, should be associated in the minds of farmers with maternal qualities, and in consequence called the "Queen" of fodder plants, just as Maize, with its sterner characteristics and greater suitability as a food for adult animals, is called the "King" of fodder plants. As food, each is complementary to the other, and their alliance when brought about on the farm is followed by the happiest results.

Lucerne was introduced into Greece during the Persian Wars, about 490 B.C., so that it is known to have been cultivated for well over 2,000 years. It has therefore been well tested. It was taken to Spain by the Moors under the name of Alfalfa. The Spaniards introduced it to Mexico, and from that country it spread over South America and extended to the United States and Canada. In Canada and America lucerne is known and cultivated as "Alfalfa." This word is believed to be of Arabic origin, and derived from words which mean "the best fodder." It will thus be seen that its great value for fodder purposes has been long recognised, and the splendid reputation which this plant so early earned, and which by its name has come to us down through the centuries, it still maintains.

It has been thought that the name Lucerne, by which it has been known in England and France, was derived from the Swiss canton of the same name, but Coburn in the "Book of Alfalfa" considers this to be a mistake, as it was not known there until long after it was cultivated in France and England. He states that:—"The name Lucerne is probably derived from the Spanish word 'Userdas,' which the French changed to 'La cuzerdo,' and later to 'Luzerne,' still later to 'Lizerne,' and then to 'Lucerne.'"

The botanical name of Lucerne is *Medicago sativa*. It belongs to the family of leguminous plants, of which it is probably the best known and most valuable member. It usually grows from 1 to 2½ feet high, but occasionally taller. It is a deep-rooting, remarkably long-lived and prolific perennial. Under the best conditions it may be cut many times a year, and year after year. It is stated that there are lucerne fields in Mexico over two hundred years old, and others in France which are known to have been productive for over a century. There is no reason to believe that it will not be equally long-lived under Australian conditions if established on suitable soil, suitably manured, and given reasonable attention. The intensive lucerne plot referred to in the issue of the "Agricultural Journal" for April, 1924, had then been established for seven years (it is now 13 years old) and is still flourishing, and shows no signs of exhaustion. Its deep roots penetrate readily to 10 to 20 feet, and have been traced to much greater depths. Coburn records a case where the roots were found penetrating through crevices in the roof of a tunnel one hundred and twenty-nine feet below the surface of a lucerne field.

CLIMATE.

Lucerne loves heat, and makes its maximum growth in spring and summer. It is at its best when plentiful supplies of water are found in combination with heat. Under such conditions, which usually involve irrigation, it is remarkably prolific, successive cuttings of luxuriant forage being obtained at intervals of five to six weeks, with an aggregate yield per acre of 20 to 25 tons of green fodder, or, if made into hay, of six to eight tons. Owing to its deep-rooting system it is well able also to withstand extremes of temperature. The writer when in New South Wales has found it growing as far north as the Queensland border, and south not far from Kosciusko. It is also well adapted to withstand summer drought. Grown experimentally without irrigation at Chapman and Merredin Experiment Farms, it has proved that it will live for several seasons through dry summers, remaining dormant during the dry weather, awaiting the summer showers or the winter rains to spring to activity.

It is believed that there is no part of the agricultural area in which this plant cannot be made to serve some useful purpose. For maximum returns for fodder or hay, irrigation will probably be necessary in most districts, but even in the drier areas sufficient information is available to indicate that it is likely to prove useful for grazing. It is anticipated, however, that its greatest usefulness will be in the Dairy Belt, and because of its great fodder value no dairyman should be without his lucerne patch.

SOIL.

Lucerne is not particular as to soil. With suitable treatment it will grow on almost all classes of soil, from nearly pure clay to light sandy soil. At one time it was thought that it would only grow on rich, deep alluvial soil, but experience has shown that there is hardly any kind of soil on which it will not

grow provided the soil is not waterlogged or sour. The most favourable soil is a rich, somewhat sandy loam, warm and friable. The highest yields are obtained with the least trouble on the very best alluvial soils found on creek and river banks well supplied with plant food and with free water from 6 to 20 feet below the surface. At one time the heavy clays were considered unsuitable, but cases are recorded where excellent crops have been raised on soils of this character, but more care is required in preparing the seed bed than on the friable loams. Whilst lucerne can utilise enormous quantities of water during the growing period, it is killed by stagnant water lying upon it. A case is known, however, where the flood waters from the Hawkesbury River remained on the lucerne paddocks for eight days during the winter, when the roots were partially dormant, and without doing it any permanent injury. In this instance the deposit left round the plants was removed as soon as the waters receded.

"Lucerne will not stand wet feet" aptly conveys the meaning of the rule that if the soil is not naturally drained to a depth of several feet, action must be taken to bring about this condition before the lucerne is planted.

PEPARATION OF SEED BED.

Lucerne likes a compact seed bed with just a little loose soil on top, and as the lucerne seed is small the soil should be well prepared. Though the lucerne plant when established is one of the hardiest of plants, yet when young it is delicate and require favourable conditions for its support. The seed bed therefore should be warm, mellow and compact, with just a thin layer of loose

Experimental Lucerne Plot—Merredin, 1919.

soil on top. It is essential that the seed bed proper be compact, in order that the seed may germinate readily and the soil moisture move most freely in all directions to convey the necessary nourishment to the young plantlet. The compact soil in which the seed is deposited should be covered, however, with a layer of loose soil, thin enough for the small and tender plant to force its way through, so that the evaporation of the moisture brought near the surface by the compaction of the underlayers for the use of the roots will be lessened.

Because of these requirements it is generally advisable to commence the preparation of the land some time before sowing, usually by fallowing, and the ploughing can then be deep. Except in rare instances the ploughing should not be done later than at least six weeks before the seed is to be sown, for if ploughed later than this it is difficult to get the seed bed into that compact condition which is so essential for the best results with the establishment of this crop. The planting of the seed on a loose seed bed is a frequent source of failure with the lucerne crop. It is also advisable that the seed bed be as free from weeds and weed seeds as it is possible to get it, for the delicate young lucerne plant cannot compete with the hardy young weeds of a dirty seed bed, though when when established the reverse is the case for it is the hardiest of plants, and but few weeds can compete with it. In its early stages weeds are very formidable and serious handicaps, and it is believed that more failures are due to the presence of weeds amongst the young lucerne plants than to any other cause.

An experiment to ascertain the effect in this connection was carried out at the Merredin Experiment Farm in 1919. This experiment was planted on forest land. The plots were one-fortieth of an acre in area—25 links wide and one chain long. The seed bed was well prepared by fallowing; on one plot the weeds were destroyed, on the other they were allowed to grow. The rainfall subsequent to the planting was good, and to the end of the year was as follows:—April, 302 points; May, 17 points; June, 105 points; July, 233 points; August, 164 points; September, 43 points; October, 186 points; November, 38 points; December, 9 points. The seed germinated well on both plots.

On the hand-weeded plots, the lucerne plants grew well. On 9th October the average height of the lucerne plants was 18 inches, and about one-fifth of them were in flower. It was then cut with a scythe and weighed; the green material was allowed to remain on the plots until cured as hay, when it was again weighed. The computed yields per acre in each case were:—Green weight, 61 cwt.; hay weight 29 cwt. 3 qrs.

On the unweeded plots the weeds, mainly barley grass, grew apace and so thickly that only a few plants of lucerne were visible. This weed growth was cut off at the same time as the lucerne on the other plots, after which the vegetation remained dormant until the rains in March. Some plants were then noticeable on these plots, but there were neither as numerous nor as vigorous as those on the plots which had been weeded.

The difference in the results obtained from the weeded and unweeded plots brings out in a marked manner the necessity of freeing young lucerne plants from the more vigorous weeds. It shows that as it is not a commercial proposition to control the weeds on a large area by hand-weeding, it is essential to obtain a seed bed as free from weeds as is possible by destroying them before the lucerne is planted. The importance of securing a seed bed free from weeds is so thoroughly recognised by one of the most successful growers of lucerne in the wheat belt of New South Wales that it was his practice to commence to prepare for lucerne three years before it was sown. This does not mean that the land was uncropped for that period, but that the cropping adopted was such as would tend to destroy weed growth. As the crop is a perennial one, the thorough preparation of the seed bed necessary to make it free from weeds and compact is justified.

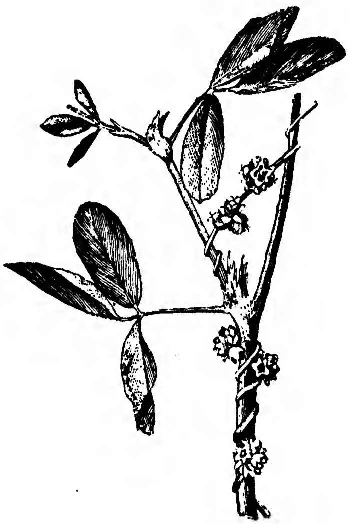
SEASON TO PLANT.

In warm and particularly the dry districts of Western Australia autumn sowing, i.e., in March and April, is likely to give best results, provided weeds can be controlled. Rain usually falls then and the ground is warm to ensure

a good germination of the seed and a vigorous growth of the plants. During the winter plants have opportunities to make a good root growth, so that the plants become strong enough to stand the hot weather of summer. On the other hand, where weed growth is troublesome, in cool districts with a liberal rainfall spring sowing may be advisable. When spring sowing is practised the ground should be fallowed in autumn or winter, so that the cultivation in winter and spring will afford opportunities for destroying weeds. This is the plan so successfully adopted in the southern districts of Wagin, Katanning and Gnowangerup, where considerable areas are planted for pasturing sheep.

DODDER.

Dodder (Cuscuta spp) is a parasitic plant vine which grows from seed. It is probably the most serious lucerne pest the grower has to face. The seed germinates in the soil and retains its connection with this until it comes into contact with the stem of the lucerne plant. It then severs its direct connection with the soil and lives upon the juices of its host, the lucerne plant, until it ripens its seed or has killed the host. Once started dodder continues to grow and spread by means of its tendrils, which grow from one plant and catch other adjacent ones. The plants first attacked begin to die and the pest spreads out in all directions.



Lucerne and Dodder.

The tiny seed of this pest is sometimes found in an admixture of lucerne seed, and because of this disastrous effect upon the crop precautions should be taken to prevent it being introduced with the lucerne seed which is being sown. Though some dodder seed can be separated from lucerne seed by suitable cleaning machinery because of the difference in their relative sizes, yet, because of the vital importance of not introducing dodder, only seed which has been harvested from crops known to be free from dodder should be used.

It may be, however, that despite the precautions taken, dodder has established itself. Every effort should be made to eradicate it. If very generally established, probably the best way of dealing with this pest will be to plough up the paddock and grow other crops upon it for a number of years until all the dodder seeds have germinated and the plants arising therefrom have been killed. For dealing with isolated patches the usual method recommended is to mow or hoe them, cover them with straw, and burn the dried material. Close and repeated grazing for some time may also prove effective, as the animals are likely to eat the dodder quite close to the ground and prevent it forming seed. Mowing has proved ineffective owing to the fact that little tendrils of the dodder plant are left on the lucerne stems near the ground and below the cut surface of the lucerne.

VARIETIES.

There are several kinds of Lucerne. These are, however, types rather than varieties, and are mainly of localised character and usually distinguished by the name of the country in which they have been grown, e.g., Peruvian, Turkestan, Arabian, African, etc. Many of these have been tried in Australia and at the Chapman Experiment Farm. The results obtained there are in accord with those obtained in the Eastern States, and are to the effect that none are as suitable for, or as prolific under Australian conditions, as the Australian type, which has been evolved as the result of the survival of the fittest. Growers should therefore insist upon being supplied with Australian seed, most of which now comes from New South Wales. Realising the superiority of seed produced in the Commonwealth, the Federal Government now insists that all imported seed shall be stained pink, so as to make it readily distinguishable from the local seed, which in colour ranges from green to purple. Most of the seed produced in the Commonwealth is grown in New South Wales in the Hunter River, Tamworth, and Mudgee districts.

During recent years advertisements have appeared in the agricultural press claiming very distinct advantages for certain strains of lucerne, the roots of which are offered for sale. These roots are said to be the progeny of a selected surface rooting plant, and it is claimed that planting them will result in the establishment of a superior type of lucerne. As the result of very careful inquiries growers cannot be advised to purchase these roots, as there is no evidence to show that they have any advantage over the best strains of the Australian variety. In this connection the following warning was issued by Mr. H. Wenholz, Director of Plant Breeding, New South Wales Department of Agriculture:—

> "Any lucerne grower knows how variable in composition his lucerne field is, consisting as it does of plants which vary considerably in habit, growth, leafiness and response to climatic conditions. The Department has had some of the well advertised lucernes under observation, and has not seen in any of them anything superior to what exists in isolated plants in any lucerne field. Growers are advised to accept with much caution the optimistic announcements being made with regard to new lucernes, especially to those the distribution of which is being effected by roots."

Good seed of the right kind is essential, and therefore the grower should see that he obtains it by using Australian-grown seed. The seedsmen are required to guarantee the germination and the maximum percentage of weed seeds and impurities in the samples offered. A good sample should have a germination of about 75 per cent., and should not contain by weight more than ½ per cent. of weed seeds and of impurities. The sale of lucerne containing dodder and other noxious weed seeds is absolutely prohibited.

RATE OF SEEDING.

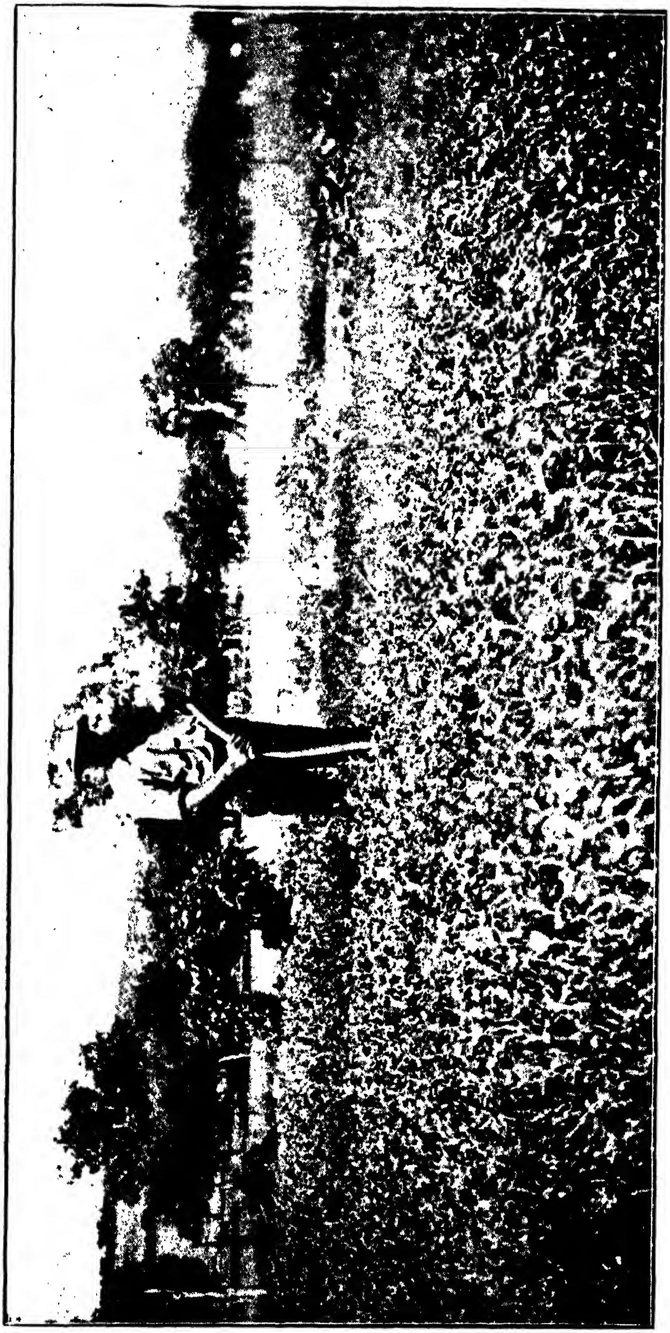
The amount of seed depends upon the purpose for which the crop is intended. For hay-making purposes the amount sown by farmers ranges from 6 to 25 lbs. per acre. If, however, it is intended that the crop shall be grazed, the quantity sown is much less and ranges from 2 to 8 lbs. per acre. In some of the lucerne growing districts of the Eastern States where lucerne hay is the staple crop the practice is to sow about 25 lbs. of seed per acre, and growers have been known to state that they would prefer to saw 30 rather than 20 lbs. per acre. This attitude is due to a realisation of the fact that many causes operate against plants succeeding and prevent more than a small percentage of the seed from producing healthy established plants; the young seedlings are tender and have difficulty in reaching the surface after germination. During the process of covering many of the seeds sink too deeply into the soil, whilst many remain quite near or on the surface and fail owing to insufficiency of moisture. Further, whilst the lucerne crop is being established a process of elimination occurs, weeds rob the soil of the fertility, use up moisture, and compete with the lucerne for light. This makes the plants thin and spindly and generally saps their vigour, and in consequence it is only the strongest plants which survive.

It is considered that, when established, a stand of some 500,000 plants per acre is ample. Seeing that 1lb. of lucerne seed contains about 220,000 seeds the use of from 2 to 3 lbs. of good seed per acre would meet these requirements, and though it is recognised that a farmer should not run the risk of a thin crop as the result of being niggardly with the seed, it is considered that the use of 6 lbs. of good seed on well prepared land allows for the many contingencies referred to, and that to use more than 12 lbs. is unduly extravagant.

METHOD OF SOWING.

Except on loose, drifting sands lucerne should not be sown with a nurse crop. There is a general agreement amongst experienced lucerne growers that if lucerne succeeds with a nurse crop it is in spite of the additional drain upon the soil moisture instead of by reason of it. This is particularly applicable to dry climates, for when there is only a limited supply of moisture available, all this will be required to germinate the seed and give the young plant a vigorous start in life.

The seed is usually broadcasted and should be sown near the surface. The seed may be broadcasted either by hand, by a hand broadcasting machine of the "Cahoon" or similar type, or through the grass seeding attachment of the ordinary grain and fertiliser drill. An even distribution of seed is desirable; it is not easy to obtain this by broadcasting with such small quantities of small seed. When necessary to sow by hand it is convenient to follow behind a roller or harrow, so as to have a clearly defined area on which to sow. The small quantity of seed used is dealt with by using the finger and thumb instead of the whole hand for picking up and spreading the seed; and sometimes to facilitate the work and ensure more even distribution the seed is mixed with dry soil or ashes. When the hand machine is used a small quantity of seed can be sown best by turning the handle the opposite way to the usual one. The seed can be sown down the seed box of the grain and fertiliser drill if mixed with some bulky material like bran. It is sometimes mixed with superphosphate and sown through the fertiliser box, but this method is not recommended on account of the destructive action of the fertiliser on the vitality of the seed. When sowing the seed through the "shoes" of the drill grain there is some risk that the seed may be



Lucerne at Nabawa. Grown by Mr. S. E. Gould.

planted too deeply, but provided this risk is known it can be guarded against and avoided. When sown down the tubes of the grain drill the seed can be deposited on the surface by removing the tubes from the "shoes," and at the same time a broadcasting effect can be obtained by arranging for the seed to be dropped on to a sloping board fixed with an inclination of about 30 degrees to the ground.

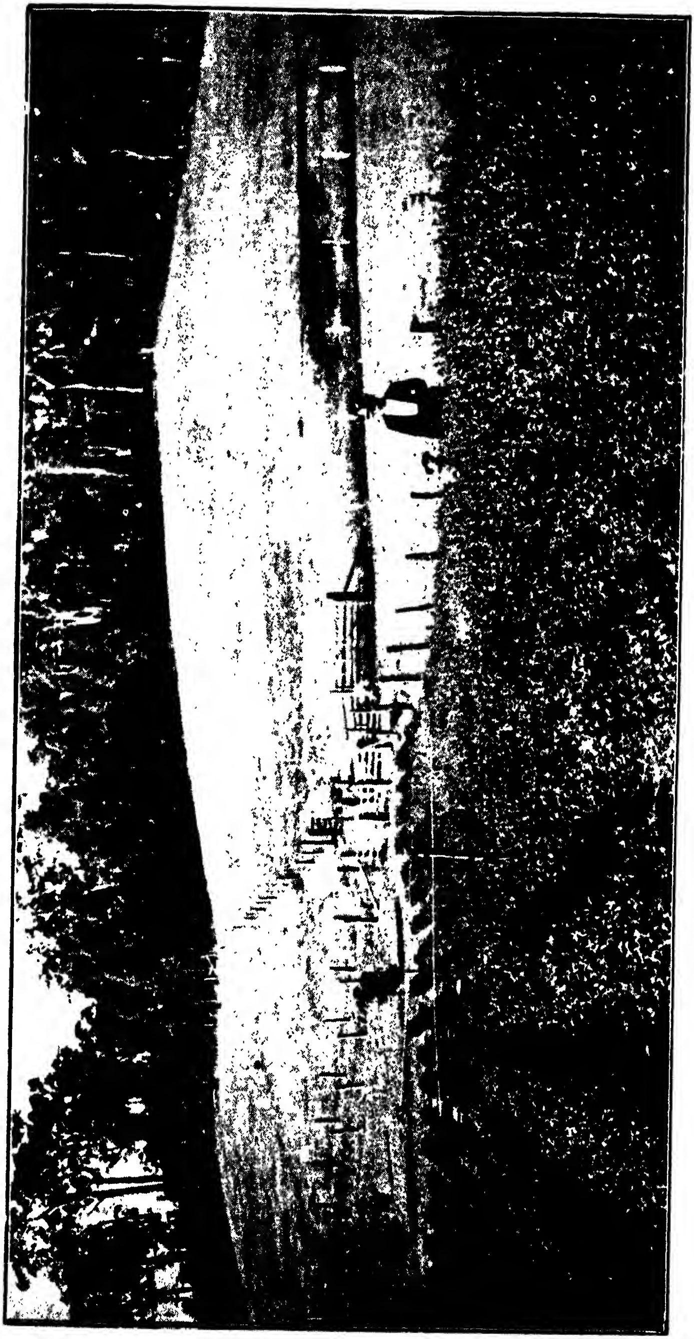
The seed is sometimes sown in drills which are far enough apart to admit of intertillage. This method is believed to be the best for dry districts, and particularly for places where weeds are troublesome, and for small patches. It is further recommended as the method to be adopted when determining the suitability of new locations for this crop. The results obtained by Mr. A. C. R. Loaring at "Lawnbrook," Bickley, with lucerne in drills 2ft. 9in. apart, and recorded in the "Agricultural Journal," April, 1924, prove that there is no need to fear lessened yields from the adoption of this method, and it has several distinct advantages. It enables the land between the rows to be kept loose by cultivation, as the result of which loss of soil moisture by evaporation is reduced to a minimum, and the water is conserved for the use of the crop. Another advantage is that the cultivation given to conserve the moisture also destroys weeds, thus preventing the crop form being robbed of the plant food and moisture which the weeds would use for their growth. It has the further advantage that a saving of seed is effected when planting in this way, for, assuming that only 50 per cent. of the plants were obtained from the seed planted, 2 lbs. of seed will provide 15 plants per foot of row if the rows are 3ft. apart. The seed is covered either by rolling or by harrowing with a light or brush harrow, but it is best covered by the joint operations of both rolling and harrowing. The rolling presses the seed into the soil, and in this way the germination is assisted; it is, however, undesirable to leave the surface compacted and smooth as left by the roller, for this tends to draw the moisture to the surface where it can be evaporated, and in addition a rolled surface crusts readily after a shower. These disadvantages can be overcome by lightly harrowing the rolled surface.

INOCULATION.

Lucerne, in common with other Legumes, is able to obtain the nitrogen for its requirements from the free nitrogen of the air, which contains about 80 per cent. It is enabled to use the free atmospheric nitrogen by the aid of certain vegetable organisms which derive their sustenance from the nitrogen of the air and the starch of the plant. When acting in this way the presence of these bacteria can be noticed by the appearance of wartlike nodules or tubercules on the roots, the nodular swellings are filled with the micro-organisms and are usually in clusters. Some are as small as a pin's head, others as large as a pea. It was thought at one time that each legume—lucerne, clover—had a distinct organism, but now it is believed that legumes of closely related kinds have the same organism and will pass from one kind to another. Thus the bacterium found on "White Sweet Clover" and on "Burr Medic" or "Burr Trefoil" have proved to be also suitable for lucerne, and similarly the one found on the Pea suitable for the Broad Bean or Vetch.

These nitrogen collecting bacteria do not act when there is an abundance of nitrogen in the soil available for the use of the legumes. They so to speak, become lazy.

Seeing that in soils deficient in nitrogen lucerne will be dependent upon the presence of nitrogen-gathering bacteria for its supplies of nitrogen, it follows that if they are not present its development will suffer and will be shown by



Lucerne in Drills—"Lawnbrook," Bickley.

the pale colour of the foliage. It is important, therefore, to have these organisms in the soil; in fact lucerne cannot be a complete success without them. Fortunately there is no record of their absence in any place where lucerne has been tried, to date, in Western Australia, and because of the manner in which clovers flourish throughout this State there is every reason to believe that they will be present naturally right throughout the agricultural areas. If, however, they should prove to be absent, they can be introduced, and this process is called inoculation. In the past the most generally adopted method of carrying out the inoculation has been to distribute over the new land intended for lucerne a small quantity of the surface soil from an old established lucerne patch. Soil containing or infected with the required bacteria, at the rate of about 100 to 200 lbs. per acre, is harrowed in with the seed or just before sowing. The danger attendant upon this method is the risk of introducing weed seeds, fungus diseases, or eelworms. Another method without the same risk is the distribution of finely cut up or ground lucerne hay with the seed or the feeding of lucerne or clover hay to the stock some time before the seed is to be planted.

It was found that these nitrogen-fixing bacteria belonging to the different groups of legumes can be isolated and prepared for distribution in convenient form as "cultures." This scientific discovery was developed to such an extent that "cultures" for the different legumes were used with great success by mixing them with seed before sowing. Recently reports from England indicate that good results have followed the application of these "cultures" to old lucerne fields.

"Cultures" for lucerne and other legumes are now prepared in the laboratory of the Pathological branch of the Department and are supplied to farmers for a small fee.

The effect of lime is to encourage the growth of these bacteria. If the crop is not suffering from excess water, and there are evidences—such as the pale colour of the leaves, or the absence of the nodules on the roots—that the necessary bacteria are not functioning, mild lime at the rate of about one ton to the acre should be applied. On sour and sandy soils a similar dressing of mild lime is also recommended to be supplied at least one month before the seed is sown. In addition to stimulating the bacterial activity already referred to, it will also have the effect of correcting the acidity which is so detrimental to success with lucerne.

MANURING.

Lucerne is a heavy feeder. Under suitable conditions twenty tons of green crop may reasonably be expected in a season, and this would contain about 340lbs. of nitrogen, 60lbs. phosphoric acid, and 250lbs. of potash. Fortunately, except during the period immediately following germination, this plant is not usually dependent upon the soil for its nitrogen supply. Being a legume it can, when suitable bacteria are present, obtain all its requirements in this connection from the inexhaustible supply contained in the air. But the phosphoric acid and potash must be obtained from that already in the soil or from fertilisers applied to the soil. On fertile loams it may be assumed that the soil will contain sufficient nitrogen to meet the requirements of the young lucerne plant, and supply its needs until the necessary bacteria are sufficiently plentiful to enable it to secure all its needs in this connection from the air. Because the young plant requires to obtain its early nitrogen requirements from the soil, a small application of nitrogenous manure—sulphate of ammonia, blood, or nitrate of soda—is, however, recommended for sandy soils or others deficient in nitrogen-forming material. Guided by experience in the Eastern States, it is unlikely that, except in sandy

soils, potash manuring will be necessary in the early stages, but it is equally likely that manuring with phosphoric acid will be followed by marked beneficial results. An application of from 2 to 3 cwt. of superphosphate per acre is recommended on all soils, even the best

On loams poor in organic matter it will be advisable to supplement the superphosphate with an application of sulphate of ammonia up to 100lbs. per acre, so as to meet the requirements of the plant for nitrogen until it is sufficiently established to obtain what it needs from the air. On such soils the fertiliser recommended is therefore:—superphosphate, 3cwt. per acre, sulphate of ammonia,

Lucerne at Wagin. Grown by Mr. G. A. W. Piesse.

1cwt. per acre. The fertiliser recommended per acre for sandy soils or those deficient in plant food is a complete one consisting of, say:— sulphate of ammonia, 100lbs.: superphosphate, 400lbs.: muriate or sulphate of potash, 400lbs.

Except in soils unusually rich it will be necessary to fertilise the crop annually. Subsequent applications of fertilisers should be governed largely by the returns aimed at or secured. If the soil is not rich enough for its latent fertility to be drawn upon, or if it is desired to replace the plant food removed by the crop, then an application of superphosphate 14lbs., sulphate or muriate or potash 25lbs., is recommended for every ton of green lucerne removed.

Well saved stable manure is very suitable for this crop, for in addition to the plant food it contains it also supplies organic matter to the soil, and this improves

its mechanical condition. If kept on the surface it acts as a mulch to conserve the moisture and will be of considerable assistance in preventing the formation of a crust on its surface. The great drawback is the weed seeds it contains for these, unless killed as the result of rotting, are likely to destroy the young lucerne plants. This objection is therefore lessened when the manure has been well rotted and is not serious when applied to well established lucerne beds.

On sour and sandy soils a dressing of air slaked lime or ground stone at the rate of 20cwt. per acre is recommended as a preliminary dressing to be applied at least one month before the seed is sown. This will have the effect of correcting acidity and stimulating bacterial activity.

TREATMENT AFTER SOWING.

Even in the best prepared soil, weeds are likely to spring up, for most soils, and particularly old and fertile ones, contain dormant weed seeds, and these germinate with the lucerne seeds and become a menace to its success. It is not possible to cultivate the ground to destroy the weeds which may grow amongst the recently-planted lucerne, for in its young state it is so delicate and with so little roothold that even a harrowing is likely to pull out or damage a considerable number of plants. Lucerne planted in the autumn will rarely be strong enough to be cultivated before the following spring, or that sown in spring before the following autumn. Short of hand-pulling, which is only possible on small areas, the most practical method of controlling weeds in young lucerne is to mow or graze them. If this latter plan is followed the grazing should be done with small stock and as quickly as possible. The mowing can be commenced when the lucerne plants are four to five inches high, and repeated after a short interval, say, a month. This mowing, though detrimental to weed growth, will not injure the lucerne, but rather will stimulate it. Usually the material from the first mowing will not be worth gathering, and it can therefore be left, with advantage, to mulch the ground. As the object of this mowing is to destroy the weeds it should be undertaken whenever they are plentiful enough to warrant it, irrespective of the condition of the lucerne plants and the necessity for utilising the crop. It is emphasised that mowing does not injure but stimulates lucerne. When the young plants have a firm roothold, and this can be determined by pulling at them, cultivation of the soil can take place with advantage. Its effect will be to stimulate the crop by letting air into the soil for the benefit of the nitrogen-fixing bacteria, and by conserving the soil moisture. For the first cultivation a light harrow is probably the best implement to use, but as the lucerne gets older much stronger implements, such as the springtooth cultivator or disc harrow can be used. One of the best implements for the purpose on established lucerne—over two years old—is the disc harrow. To one not accustomed to its use it may be thought that it will destroy the lucerne as well as cultivate the soil. This, however, is not so. The discs should not be given too much angle, and they will then split the lucerne crowns and cause them to throw up additional stems.

When the soil of an established lucerne bed becomes hard it can be disced and cross-disced to loosen it up with most beneficial results. There need be no fear that surface cultivation will kill the plants, as they are too deeply rooted to be injured, and the splitting of the crowns is beneficial. Discing and cross-discing is extremely useful should the paddock unfortunately become infested with couch grass. On one occasion the writer had reason to deal with such a paddock, and so badly infested with it that the treatment decided upon was desperate and almost in the nature of a forlorn hope. The ten-acre paddock was double disced twice both ways. The result was astonishing. The lucerne grew

with such astonishing vigour as to keep the couch under control when aided by the usual periodical cultivations with the disc, and because of the success which followed this drastic treatment, and which proved that couch grass and weeds could be controlled in established lucerne patches, additional acres of lucerne were planted on that farm.

FEEDING LUCERNE.

Lucerne as a food is particularly valuable for the protein it contains. Henry gives the average digestible nutrients in freshly cut lucerne and green fodder maize as:—

	Digestible nutrients per 100lbs.		
	Protein.	Carbo-hydrates.	Fat.
Green fodder maize	1.0	11.6	0.4
Green lucerne	3.9	12.7	0.5

From this it will be seen that green lucerne contains nearly four times as much protein as green maize.

The nutrient protein is the most expensive of our food constituents and is essential for the production of lean meat, wool, milk, and eggs. Young animals, cows in milk, and laying hens require much protein, and because of the large amount of protein which it contains lucerne is very suitable for these animals. It can in many instances profitably take the place of bran or oilcake in the ration, particularly of milking cows, and which farmers may have to purchase in order to utilise profitably and economically the other products of the farm, or to maintain a continuous milking period.

Comparative analyses of bran and lucerne hay, as given by Henry, are as hereunder:—

	Digestible nutrients per 100lbs.		
	Protein.	Carbo-hydrates.	Fat.
Lucerne hay	11.0	39.6	1.2
Wheat bran	12.2	39.2	2.7

From the above the similarity between the two is obvious, and it is estimated that in practice 11lbs. of good lucerne hay is equal to 10lbs. of bran. In one respect lucerne has a very decided advantage over bran, and that is as a food for pigs. Lucerne is one of the best foods and bran one of the worst for these animals. In the United States of America large numbers of pigs are regularly pastured upon lucerne, and in this connection it is estimated that a vigorous patch of lucerne will carry 15 to 25 pigs per acre, and the pigs will made a gain of about 100lbs. during the season. Whilst grazing lucerne with pigs it is best to supplement it with an allowance of grain, like maize or wheat. For fattening purposes lucerne will not be found economical if fed alone, but when fed alone all its protein cannot be digested and though the animals increase in weight such increase is principally of bone, blood, and muscle. For fattening animals lucerne requires to be supplemented with foods like maize, wheat, and oats, and other foods richer than lucerne in carbo-hydrates and fat.

HAYMAKING.

The object of transforming the green material into hay is to get rid of excessive moisture so that the hay when stacked will not heat too much or become mouldy.

Lucerne is much more difficult to make into hay than the cereals. This is because of the very sappy character of the stems, which do not dry as readily as the leaves. These latter are the most nutritious part of the plant, and if they become very dry are likely to fall off the stem during the operations of hay-making. The great object to be achieved therefore is to regulate the drying as far as possible so that the leaves and stems dry simultaneously. The principle underlying the procedure necessary for this is founded upon the fact that the leaves until they are so dry that they cease to function will transpire quite a lot of water and which they will draw from the sappy stems. The methods to be adopted should therefore aim to keep the leaves limp as long as possible, as whilst in this condition they will be drawing sap away from the stems very effectively. In practice the hay is made as far as possible in the windrows or in heaps or "cocks."

Lucerne may be cut at any time for green feed, and it may be accepted as an axiom that it is better at all times to cut early than late. Some farmers commence to cut the crop for hay shortly after the first flowers have appeared, others when the lower leaves begin to change colour, in some instances this latter may happen and the leaves begin to drop and the stems

Lucerne at Denmark. Grown by Mr. J. Haine

harden before the blooms appear. Unless the weather is very unsuitable for haymaking the mowing should not be delayed or loss may occur in three ways; in the first place the later cut or more mature material is less digestible, for after flowering the food constituents are transferred to the upper portions of the plant, the stems harden and become less digestible than when younger; in the second place some of the leaves wither and drop off and this results in loss in weight, and finally, deferred cutting leads to poorer growth in the succeeding crop and may also result in a lessened number of cuttings during the season because of the greater time which the respective cuttings occupy the land.

The following table showing some results obtained at the Utah Experiment Station in a feeding test indicates the loss of nutriment following upon delay in cutting.

Stage of growth and beef lbs. produced per ton of hay—

When 1-10 in bloom—706 lbs.
When in full bloom—562 lbs.
When 1-2 of blooms have fallen—490 lbs.

At the Kansas Experiment Station results obtained and the decline in the protein content consequent upon later cutting are as follow:—

Stage of growth and protein content—

When 1-10 in bloom—18.5 per cent. protein.
When 1-2 in bloom—17.2 per cent. protein.
When in full bloom—14.4 per cent. protein.

The first cutting for hay is ready early in spring, and except in the wheat areas this crop will be difficult to make into hay on account of its sappy nature and the lack of much sun heat at this time. If this cutting can be used for feeding to stock in its green state it is advisable to use it in this way. The second and succeeding crops are much more easily converted into hay. In New South Wales when a crop of seed is required the third crop is usually utilised for this purpose, as the flowering at this period is usually more uniform than at others.

Lucerne is usually mown with a scythe, mowing machine, and on occasions with a reaper and binder; it should be cut as close to the ground as is possible without injuring the blade, so as to get the maximum amount of material and to force the new growth from the crown instead of from the joints of the old stems. The usual practice is to start when fine bright weather is expected and as early in the morning as is possible, but not until any dew which may have been deposited has evaporated. It is undesirable that the cut material be allowed to remain in the swath too long, especially if the weather be hot, for extreme heat causes rapid drying of the leaves, and these are likely to fall off during the subsequent operations. If it is allowed to remain just long enough to wilt during bright fine warm weather, this will take only a few hours, whereas with cool moist conditions it may take as many days. After being wilted the material should be raked at once into windrows. If the day is a bright sunny one and the mower has been started in the morning, the rake can be started at mid-day, and should catch the mower before night. The next morning the material in the windrows can be placed into heaps or "cocks," and if the weather remains favorable it is probable that the lucerne will be fit to stack the following morning.

Sometimes during hot weather the curing is completed entirely in the windrows, which should be made loose so as to admit the air freely, but in cool damp weather it will be advisable to place the material in "cocks" and allow the curing to finish in them. When dry enough or "cured," the hay is ready to be carted for stacking or baling. This is determined by an examination of the stalks, which need not be dry and brittle, but tough, though without any sap being noticeable when the stems are twisted tightly.

Just before carting, the "cocks" are sometimes turned over to expose the bottom hay for an hour or so to the sun, so as to dry off any hay that may be slightly damp owing to its proximity to the ground. Sometimes in very hot weather the hay becomes too brittle as the day advances, and there is a danger of losing the leaves, and the carting has to be confined to the mornings.

The time occupied from mowing to carting will vary with the season and according to the weather prevailing during the operations. Usually it is under three days, but may be as short as 24 hours. An extreme case is that of Mr. P. Reynolds, "Hobartville," Richmond, who on one occasion stacked his hay in the shed 16 hours after cutting.

Lucerne hay does not shed the rain well, and when stacked in the open should be thatched or protected in some other way from rain. It is best stored in sheds, and should not be stacked on the ground or on a raised straddle of earth; it requires a foundation or straddle of poles to admit air to the bottom of the stack. If stacked on the ground some is sure to spoil.

SUMMARISED.

Lucerne has many virtues, these have been summarised in most picturesque language by Geo. L. Clothier, of whom it is stated by Coburn in the "Book of Alfalfa" that he has studied his subject closely in the field, in the feed lot and the laboratory. His summing up is as follows:—

"The cultivation and feeding of alfalfa mark the highest development of our modern agriculture. Alfalfa is one of nature's choicest gifts to man. It is the preserver and the conserver of the homestead. It is peculiarly adapted to a country with a republican government, for it smiles alike on the rich and the poor. It does not fail from old age. It loves the sunshine, converting the sunbeams into gold coin in the pockets of the thrifty husbandman. It is the greatest mortgage lifter yet discovered.

"The alfalfa plant furnishes the protein to construct and repair the brains of statesmen. It builds up the muscles and bones of the war-horse, and gives his rider sinews of iron. Alfalfa makes the hens cackle and the turkeys gobble. It induces the pigs to squeal and grunt with satisfaction. It causes the contented cow to give pailsfull of creamy milk, and the Shorthorn and whitefaced steers to bawl for the feed rack. Alfalfa softens the disposition of the colt and hardens his bones and muscles. It fattens lambs as no other feed, and promotes a wool clip that is a veritable golden fleece. It compels skim-milk calves to make gains of two pounds per day. It helps the farmer to produce pork at a cent and half a pound and beef at two cents.

"Alfalfa transforms the upland farm from a sometime waste of gullied clay banks into an undulating meadow fecund with plant food. It drills for water, working 365 days in the year without any recompense from man. The labour it performs in penetrating the subsoil is enormous. No other agricultural plant leaves the soil in such good physical condition as alfalfa. It prospects beneath the surface of the earth and brings her hidden treasure to the light of day. It takes the earth, air, moisture and sunshine, and transmutes them into nourishing feed stuffs and into tints of green and purple, and into nectar and sweet perfumes, alluring the busy bees to visits of reciprocity, whereon they caress the alfalfa blossoms, which, in their turn, pour out secretions of nectar fit for Jupiter to sip. It forms a partnership with the micro-organisms of the earth by which it is enabled to enrich the soil upon which it feeds. It brings gold into the farmer's purse by processes more mysterious than the alchemy of old. The farmer with a fifty-acre meadow of alfalfa will have steady, enjoyable employment from June to October, for as soon as he has finished gathering the hay at one end of the field it will be again ready for the mower at the other. The homes surrounded by fields of alfalfa have an aesthetic advantage unknown to those where the plant is not grown. The alfalfa meadow is clothed with purple and green, and exhales fragrant balmy odours throughout the growing season to be wafted by the breezes into the adjacent farmhouses."

FERTILISERS.

N. DAVENPORT, B.Sc. (Agr.).
Inspector of Fertilisers.

The Fertilisers Act, 1928, provides that all registrations shall operate for one year only, and therefore, to comply with its provisions, all registrations must be renewed every twelve months. The commencement of the fertiliser year has been fixed by the Act as November 1st, and all registrations now in effect are shown in the appended table.

The unit values for 1931, which are given below, show but little variation from those of the previous year, with which they are compared. The most marked difference is that in ammoniacal nitrogen, which shows a reduction from 15s. 3d. to 12s. 8d. per unit. The prices of organic fertilisers are still comparatively high and it is a decided rise to organic nitrogen at 32s. per unit. Nitrate nitrogen has fallen 6d. per unit from 20s. 6d. to 20s.

All other figures have remained practically constant, except those for potash. For this ingredient an increase of 6d. per unit has occurred when it is combined in the sulphate form.

The price of superphosphate, which is by far the most important fertiliser in this State as regards its consumption, has remained practically constant, the variation being 1d. drop per unit of water soluble phosphoric acid.

UNIT VALUES.

	1930.		1931.	
	s.	d.	s.	d.
Nitrogen.				
As Blood and Bone, Bonedust, and Bone and Flesh ..	32	0	32	0
Nitrate ..	20	6	20	0
Urea ..	19	6	19	8
Ammonia ..	15	3	12	8
Phosphoric Acid.				
As *Water Soluble* ..	4	2	4	1
As *Citrate Soluble*—				
In Blood and Bone, Bonedust, and other animal Fertilisers ..	6	6	6	6
In other Fertilisers ..	4	2	4	1
As *Acid Soluble*—				
In Blood and Bone, Bonedust, and other animal Fertilisers ..	6	6	6	6
In Basic Phosphate ..	5	6	5	6
In Superphosphate and Rock Phosphate ..	2	6	2	6
In other Fertilisers ..	1	0	1	0
Potash.				
As Sulphate ..	5	6	6	0
As Muriate ..	4	10	4	11

FERTILISERS.

The following Fertilisers have been registered at the Department of Agriculture, under the Fertilisers Act, 1928, for the year commencing 1st November, 1930:—

Name of Fertiliser.	Firm.	Brand.	Fertilising Ingredients. Nitrogen as Nitrate.	Nitrogen as Ammonia.	Nitrogen as Blood and Bone.	Nitrogen as Bone.	Phosphoric Acid P_2O_5 as Water sol.	Phosphoric Acid P_2O_5 as Citrate sol.	Phosphoric Acid P_2O_5 as Acid sol.	Phosphoric Acid P_2O_5 as Total.	Potash K_2O as Sulphate.	Potash K_2O as Muriate.	Price per ton on rails at Works or Perth.
A.—MINERAL. 1. NITROGENOUS. (a) *Nitrogen as Nitrate.*			%	%	%	%	%	%	%	%	%	%	£ s. d.
Nitrate of Soda	Cuming, Smith–Mt. Lyell Farmers' Fertilisers, Ltd.	Sickle ...	15·5	...	...	...	...	...	...	...	...	...	15 4 0
Do. do.	do. do. do.	ML in diamond	15·5	...	...	...	...	...	...	...	...	...	15 4 0
Do. do.	do. do. do.	CSML ...	15·5	...	...	...	...	...	...	...	...	...	15 4 0
Do. do.	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	15·0	...	...	...	...	...	...	...	...	...	15 12 6
Nitrate of Lime	do. do. do.	do. ...	15·5	...	...	...	...	...	...	...	...	...	16 0 0
Do. do.	J. A. Newman & Co. ...	BA over SF in circle	15·5	...	...	...	...	...	...	...	...	...	16 0 0
(b) *Nitrogen as Ammonia.*													
Sulphate of Ammonia ...	Cuming, Smith—Mt. Lyell Farmers' Fertilisers, Ltd.	Sickle ...	...	20·5	...	...	...	...	...	...	...	...	13 0 0
Do. do. ...	do. do. do.	ML in diamond	...	20·5	...	...	...	...	...	...	...	...	13 0 0
Do. do. ...	do. do. do.	CSML ...	...	20·5	...	...	...	...	...	...	...	...	13 0 0
Do. do. ...	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	20·0	...	...	...	...	...	...	...	...	13 0 0
Do. do. ...	J. A. Newman & Co. ...	BA over SF in circle	...	20·6	...	...	...	...	...	...	...	...	13 0 0
Do. do. ...	F. Viles	Imperial Chemical Industries	...	20·6	...	...	...	...	...	...	...	...	13 0 0
(c) *Nitrogen as Miscellaneous.*													
Calnitro	J. A. Newman & Co. ...	BA over SF in circle	20·5	...	...	...	...	...	...	...	...	...	14 15 0
Floranid	do. do. ...	do. do.	...	46·0	...	...	...	...	...	...	...	...	56 0 0
Urea	do. do. ...	do. do.	...	46·0	...	...	...	...	...	...	...	...	45 0 0
2. PHOSPHATIC. (a) *Rock Phosphates.*													
Pacific Islands Phosphate ...	Cuming, Smith–Mt. Lyell Farmers' Fertilisers, Ltd.	Sickle ..	...	...	...	...	...	...	36·65	36·65	...	...	4 11 6
Do. do. ...	do. do. do.	ML in diamond	...	...	...	...	...	...	36·65	36·65	...	...	4 11 6
Do. do. ...	do. do. do.	CSML ...	...	...	...	...	...	...	36·65	36·65	...	...	4 11 6
Phosphate Powder	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	...	...	...	...	...	34·80	34·80	...	...	4 10 0

(b) Superphosphates.													
Florida Superphosphate, 22 %	Cuming, Smith-Mt. Lyell Farmers' Fertilisers, Ltd.	Sickle ...	..	...	...	...	20·5	·5	1·0	22·0	...	...	4 10 0
High Grade Superphosphate, 22 %	do. do. do.	ML in diamond	...	...	...	...	20·5	·5	1·0	22·0	...	...	4 10 0
Superphosphate, 22 % ...	Cuming, Smith-Mt. Lyell Farmers' Fertilisers, Ltd.	CSML ...	..	...	...	...	20·5	·5	1·0	22·0	...	...	4 10 0
Florida Superphosphate, 24 %	do. do. do.	Sickle ...	..	...	...	...	22·0	·5	1·5	24·0	...	...	4 15 0
High Grade Superphosphate, 24 %	do. do. do.	ML in diamond	..	...	...	...	22·0	·5	1·5	24·0	...	...	4 15 0
Superphosphate, 24 % ...	do. do. do.	CSML ...	...	...	...	...	22·0	·5	1·5	24·0	...	...	4 15 0
22 Superphosphate	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	...	...	...	20·5	·5	1·0	22·0	...	...	4 15 0
24 Superphosphate	do. do. do.	do. ...	...	...	...	...	22·0	·5	1·5	24·0	...	...	5 0 0
46 Superphosphate	do. do. do.	do. ...	...	...	...	...	46·0	...	...	46·0	...	...	11 5 0
(c) Rock Phosphates and Superphosphate.													
Phosphate Mixture	Cuming, Smith-Mt. Lyell Farmers' Fertilisers, Ltd.	Sickle ...	...	...	...	...	10·0	1·0	18·0	29·0	...	...	4 11 6
do. do.	do. do. do.	ML in diamond	...	...	...	...	10·0	1·0	18·0	29·0	...	...	4 11 6
Do. do.	do. do. do.	CSML ...	...	...	...	...	10·0	1·0	18·0	29·0	...	...	4 11 6
50-50 Phosphate	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	...	...	...	9·16	1·84	17·40	28·40	...	...	5 0 0
(d) Basic Phosphates.													
Basic Phosphate	Cuming Smith-Mt. Lyell Farmers' Fertilisers Ltd.	Sickle ...	...	...	...	...	...	...	17·0	17·0	...	...	4 14 0
Do. do.	do. do. do.	ML in diamond	...	...	...	...	...	...	17·0	17·0	...	...	4 14 0
Do. do.	do. do. do.	CSML ...	...	...	...	...	...	...	17·0	17·0	...	...	4 14 0
3. Potassic.													
(a) Potash as Sulphate.													
Sulphate of Potash	Cuming, Smith Mt. Lyell Farmers' Fertilisers, Ltd.	Sickle ...	...	...	...	...	...	...	...	...	48·6	...	14 6 6
Do. do.	do. do. do.	ML in diamond	...	...	...	...	...	...	...	...	48·6	...	14 6 6
Do. do.	do. do. do.	CSML ...	...	...	...	...	...	...	...	...	48·6	...	14 6 6
Do. do.	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	...	...	...	...	...	...	...	48·5	...	14 12 6
Do. do.	Dalgety & Co., Ltd. ...	Stork ...	...	...	...	...	...	...	...	...	48·0	...	15 0 0
Do. do.	N. L. Burnell & Co. ...	Sun (and diagram)	...	...	...	...	...	...	...	...	48·0	...	15 0 0
(b) Potash as Muriate.													
Muriate of Potash	Cuming, Smith-Mt. Lyell Farmers' Fertilisers, Ltd.	Sickle ...	...	...	...	...	...	...	...	...	...	50·4	12 1 6
Do. do.	do. do. do.	ML in diamond	...	...	...	...	...	...	...	...	...	50·4	12 1 6
Do. do.	do. do. do.	CSML ...	...	...	...	...	...	...	...	...	...	50·4	12 1 6
Do do.	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	...	...	...	...	...	...	...	...	50·0	12 10 0
Do. do.	Dalgety & Co., Ltd. ...	Stork ...	...	...	...	...	...	...	...	...	...	50·0	13 0 0
Do. do.	N. L. Burnell & Co. ...	Sun (and diagram)	...	...	...	...	..	...	...	...	...	50·0	13 0 0
30 % Potash Salts	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	...	...	...	...	...	...	...	...	30·0	8 0 0

FERTILISERS—*continued*.

Name of Fertiliser.	Firm.	Brand.	Fertilising Ingredients. Nitrogen as: Nitrate.	Nitrogen as: Ammonia.	Nitrogen as: Blood and Bone.	Nitrogen as: Bone.	Phosphoric Acid P_2O_5 as: Water sol.	Phosphoric Acid P_2O_5 as: Citrate sol.	Phosphoric Acid P_2O_5 as: Acid sol.	Phosphoric Acid P_2O_5 as: Total.	Potash K_2O as: Sulphate.	Potash K_2O as: Muriate.	Price per ton on rails at Works or Perth.
			%	%	%	%	%	%	%	%	%	%	£ s. d.
A.—MINERAL—*continued*.													
4. NITROGEN AND PHOSPHORIC ACID.													
Ammonia and Phosphate ...	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	2·0	...	...	8·3	1·6	15·7	25·6	...	...	6 5 0
Ammonia and Phosphate No. 2	do. do. do.	do.	...	3·5	...	...	15·0	·4	1·6	17·0	...	...	7 2 6
Diammonphosphate	J. A. Newman & Co. ...	BA over SF in circle	...	20·6	...	...	53·0	...	...	53·0	...	...	40 0 0
Floraphos	do. do. ...	do. do.	...	20·6	...	...	53·0	...	...	53·0	...	...	47 0 0
Nitrosuper	Cuming, Smith-Mt. Lyell Farmers' Fertilisers, Ltd.	Sickle ...	...	1·5	...	...	16·0	·4	2·1	18·5	...	...	5 9 0
Do.	do. do. do.	ML in diamond	...	1·5	...	...	16·0	·4	2·1	18·5	...	...	5 9 0
Do.	do. do. do.	CSML ...	...	1·5	...	...	16·0	·4	2·1	18·5	...	...	5 9 0
No. 2 Potato	do. do. do.	ML in diamond	...	3·5	...	...	15·0	·4	1·6	17·0	...	...	6 19 0
No. 6 Potato	do. do. do.	ML in diamond	...	6·0	...	...	13·5	·4	1·6	15·5	...	...	8 9 0
Special Potato Manure C ...	do. do. do.	Sickle ...	...	3·5	...	...	15·0	·4	1·6	17·0	...	...	6 19 0
Special Potato Manure F ...	do. do. do.	do.	...	6·0	...	...	13·5	·4	1·6	15·5	...	...	8 9 0
Special Potato Manure C ...	do. do. do.	CSML ...	...	3·5	...	...	15·0	·4	1·6	17·0	...	...	6 19 0
Special Potato Manure F ...	do. do. do.	do.	...	6·0	...	...	13·5	·4	1·6	15·5	...	...	8 9 0
Potato Fertiliser X	Binney & Son	Swan ...	...	3·2	...	...	...	...	11·34	11·34	...	...	7 7 6
Do. do.	D. F. Carbarns & Co. ...	Crown ...	...	3·2	...	...	10·25	...	1·09	11·34	...	...	7 7 6
5. NITROGEN AND PHOSPHORIC ACID AND POTASH.													
Mixed Manure	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	1·5	...	...	7·1	1·4	13·5	22·0	7·5	...	7 12 6
Nitrophoska (N.17.5, P_2O_5 13.0, K_2O 22.0	J. A. Newman & Co. ...	BA over SF in circle	...	17·5	...	...	13·0	...	...	13·0	22·0	...	23 0 0
Nitrophoska (N.15.0, P_2O_5 11.0, K_2O 26.5)	do. do. ...	do. do.	...	15·0	...	...	11·0	...	...	11·0	26·5	...	22 5 0
Nitrophoska (N.15.5, P_2O_5 15.5, K_2O 19.0)	do. do. ...	do. do.	...	15·5	...	...	15·0	·5	...	15·5	19·0	...	23 0 0
Nitrophoska (N.16.5, P_2O_5 16.5, K_2O 21.5)	do. do. ...	do. do.	...	16·5	...	...	16·5	...	...	16·5	21·5	...	23 0 0
No. 3 Potato	Cuming, Smith-Mt. Lyell Farmers' Fertilisers, Ltd.	ML in diamond	...	3·75	...	...	14·5	·35	·75	15·6	4·5	...	8 1 6
No. 4 Potato	do. do. do.	do. do.	...	3·75	...	...	14·0	·3	·7	15·0	8·0	...	8 16 6
No. 7 Potato	do. do. do.	do. do.	...	3·5	...	...	10·5	·2	·6	11·3	16·0	...	10 6 6
No. 8 Potato	do. do. do.	do. do.	...	4·0	...	...	12·7	·3	·7	13·7	9·0	...	9 1 6
Orchard Manure	do. do. do.	do. do.	...	2·0	...	...	14·0	·4	1·6	16·0	5·0	...	6 19 0

Do.	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	1·5	...	...	7·1	1·4	13·5	22·0	7·5	...	7 12 6
Orchard Fertiliser, No. 3	Binney & Son	Swan	...	2·0	...	...	...	...	16·0	16·0	5·0	...	7 7 6
Potato Fertiliser	do.	do.	...	3·2	...	...	...	...	12·25	12·25	4·0	...	8 12 6
Potato Fertiliser	D. F. Carbarns & Co.	Crown	...	3·2	...	...	10·25	...	2·0	12·25	4·0	...	8 12 6
Potato Special	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	4·0	...	...	12·5	·5	·75	13·75	8·75	...	9 10 0
Potato Manure	do. do. do.	do.	...	1·5	...	...	7·1	1·4	13·5	22·0	7·5	...	7 12 6
Potato Manure No. 2	do. do. do.	do.	...	8·2	...	...	8·2	...	...	8·2	10·0	...	11 0 0
Special Orchard Fertiliser, No. 1	Binney & Son	Swan	...	8·25	...	...	8·05	·61	...	8·66	10·0	...	12 2 6
Special Fertiliser	Cuming, Smith–Mt. Lyell Farmers' Fertilisers, Ltd.	Sickle	...	8·25	...	...	8·05	·20	·39	8·64	10·0	...	11 14 0
Do. do.	do. do. do.	ML in diamond	...	8·25	...	...	8·05	·20	·39	8·64	10·0	...	11 14 0
Do. do.	do. do. do.	CSML	...	8·25	...	...	8·05	·20	·39	8·64	10·0	...	11 14 0
Special Potato Fertiliser	do. do. do.	Sickle	...	7·5	...	...	6·4	...	...	6·4	13·25	...	11 14 0
Do. do.	do. do. do.	ML in diamond	...	7·5	...	...	6·4	...	...	6·4	13·25	...	11 14 0
Do. do.	do. do. do.	CSML	...	7·5	...	...	6·4	...	...	6·4	13·25	...	11 14 0
Special Potato Manure B	do. do. do.	Sickle	...	3·75	...	...	14·5	·35	·75	15·6	4·5	...	8 1 6
Do. do.	do. do. do.	CSML	...	3·75	...	...	14·5	·35	·75	15·6	4·5	...	8 1 6
Special Potato Manure E	do. do. do.	Sickle	...	3·5	...	...	14·0	·3	·7	15·0	8·0	...	8 16 6
Do. do.	do. do. do.	CSML	...	3·5	...	...	14·0	·3	·7	15·0	8·0	...	8 16 6
Special Potato Manure G	do. do. do.	Sickle	...	3·5	...	...	10·5	·2	·6	11·3	16·0	...	10 6 6
Do. do.	do. do. do.	CSML	...	3·5	...	...	10·5	·2	·6	11·3	16·0	...	10 6 6
Special Potato Manure H	do. do. do.	Sickle	...	4·0	...	...	12·7	·3	·7	13·7	9·0	...	9 1 6
Do. do.	do. do. do.	CSML	...	4·0	...	...	12·7	·3	·7	13·7	9·0	...	9 1 6
Special Tomato Manure	do. do. do.	Sickle	...	3·5	...	...	14·0	·3	·7	15·0	8·0	...	8 16 6
Do. do.	do. do. do.	ML in diamond	...	3·5	...	...	14·0	·3	·7	15·0	8·0	...	8 16 6
Special Market Garden Manure	do. do. do.	Sickle	...	3·5	...	...	14·0	·3	·7	15·0	8·0	...	8 16 6
Do. do. do.	do. do. do.	ML in diamond	...	3·5	...	...	14·0	·3	·7	15·0	8·0	...	8 16 6
Special Orchard Manure	do. do. do.	Sickle	...	2·0	...	...	14·0	·4	1·6	16·0	5·0	...	6 19 0
Do. do.	do. do. do.	CSML	...	2·0	...	...	14·0	·4	1·6	16·0	5·0	...	6 19 0
Urea Potash Phosphate	J. A. Newman & Co.	BA over SF in circle	...	28·0	...	...	14·0	...	...	14·0	14·0	...	25 0 0
Vine Manure	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	1·5	...	...	7·1	1·4	13·5	22·0	7·5	...	7 12 6
6. MISCELLANEOUS.													
Sulphate of Iron	Cuming, Smith–Mt. Lyell Farmers' Fertilisers, Ltd.	Sickle	...	...	...	...	...	...	...	...	...	...	11 1 6
Do. do.	do. do. do.	ML in diamond	...	...	...	...	...	...	...	...	...	...	11 1 6
Do. do.	do. do. do.	CSM	...	...	...	...	...	...	...	...	...	...	11 1 6
B.—ORGANIC OR PARTLY ORGANIC.													
1. ENTIRELY ORGANIC. *(a) Bone dust or Bonemeal.*													
Bonedust	Henry Wills & Co.	W in diamond	...	...	...	2·75	...	6·0	13·0	19·0	...	...	10 0 0
Bonedust Standard	Binney & Son	Swan	...	...	...	2·75	...	...	18·3	18·3	...	...	10 15 0
Do. do.	D. F. Carbarns & Co.	Crown	...	...	...	2·75	...	...	18·3	18·3	...	...	10 15 0
Bonedust Special, No. 1	Binney & Son	Swan	...	...	...	3·5	...	...	22·0	22·0	...	...	12 10 0
Do. do.	D. F. Carbarns & Co.	Crown	...	...	...	3·5	...	...	22·0	22·0	...	...	12 10 0

FERTILISERS—*continued.*

Name of Fertiliser.	Firm.	Brand.	Fertilising Ingredients. Nitrogen as: Nitrate.	Ammonia.	Blood and Bone.	Bone.	Phosphoric Acid P_2O_5 as: Water sol.	Citrate sol.	Acid sol.	Total.	Potash K_2O as: Sulphate.	Muriate.	Price per ton on rails at Works or Perth.
5. NITROGEN AND PHOSPHORIC ACID, ETC.—*contd.*			%	%	%	%	%	%	%	%	%	%	£ s. d.
1. ENTIRELY ORGANIC—*continued.*													
(*a*) *Bonedust or Bonemeal—continued.*													
Pure Bonedust	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	...	...	3·5	...	...	22·0	22·0	...	...	12 10 0
Standard Bonedust	do. do. do.	do.	...	...	...	2·75	...	...	18·3	18·3	...	...	10 15 0
Bonedust	W.A. Meat Exports Co., Ltd.	Eclipse ...	...	...	...	3·5	...	...	22·0	22·0	...	...	12 10 0
(*b*) *Bone Fertilisers.*													
Blood and Bone	E. M. Haywood & Co. ...	Cockbills ...	...	...	5·0	...	...	3·0	9·0	12·0	...	...	14 0 0
Do. do.	W.A. Meat Exports Co., Ltd.	Eclipse ...	...	...	6·0	...	...	...	12·0	12·0	...	...	13 0 0
Do. do.	Cuming, Smith-Mt. Lyell Farmers' Fertilisers, Ptd.	Sickle ...	...	...	6·0	...	...	...	15·0	15·0	...	...	13 4 0
Do. do.	do. do. do.	ML in diamond	...	...	6·0	...	...	...	15·0	15·0	...	...	13 4 0
Do. do.	Cresco Fertilisers (W.A.), Ltd.	Cresco ...	...	...	5·0	...	...	...	12·0	12·0	...	...	13 0 0
Do. do.	State Abattoirs	State Abattoirs	...	...	6·0	...	...	...	9·0	9·0	...	...	12 10 0
Do. do.	A. H. Hasell	Sun	...	...	5·25	...	...	6·5	6·5	13·0	...	...	14 0 0
Do. do.	Haynes & Clements ...	A1	...	...	5·25	...	...	3·0	9·0	12·0	...	...	13 0 0
Do. do.	Wyndham Meatworks Co.	Wyndham Meat Works	...	...	5·75	...	...	6·0	7·0	13·0	...	...	11 5 0
Blood and Bone, ABC ...	Paterson & Co., Ltd. ...	Patco ...	...	...	5·25	...	...	3·0	9·0	12·0	...	...	13 0 0
Blood and Bone, Moon ...	do. do. ...	do.	...	...	5·0	...	...	...	9·0	9·0	...	...	*
Blood and Bone, Globe ...	do. do. ...	do.	...	...	5·0	...	...	...	9·0	9·0	...	...	*
Blood and Bone, A Grade ...	Binney & Son	Swan ...	...	...	7·0	...	...	...	15·0	15·0	...	...	16 0 0
Blood and Bone, B Grade ...	do.	do.	...	...	6·0	...	...	...	12·0	12·0	...	...	13 0 0
Blood and Bone, A ...	D. F. Carbarns & Co. ...	Crown ...	...	...	7·0	...	...	...	15·0	15·0	...	...	16 0 0
Blood and Bone, B ...	do. do. ...	do.	...	...	6·0	...	...	...	12·0	12·0	...	...	13 0 0
Blood and Bone Fertiliser ...	do. do. ...	do.	...	...	5·6	...	...	...	14·0	14·0	...	...	11 10 0
Fish Fertiliser	Binney & Son	Swan ...	...	...	4·5	...	...	...	12·0	12·0	...	...	13 0 0
Garden Fertiliser, C... ...	do.	do.	...	...	3·0	...	...	...	11·0	11·0	...	...	10 0 0
Garden Fertiliser D ...	do.	do.	...	...	1·85	...	...	...	8·3	8·3	...	...	8 10 0
Globe Bone Manure ...	do.	do.	...	...	2·0	...	...	...	18·0	18·0	...	...	8·15 0
Special Bone Fertiliser ...	do.	do.	...	...	5·3	...	...	...	11·13	11·13	...	...	14 0 0

2. Partly Organic.

(a) Nitrogen and Phosphoric Acid.														
Bone and Super.	Cresco Fertilisers (W.A.), Ltd.	Cresco	...	...	...	...	2·0	9·5	3·9	3·0	16·4	...	...	7 17 6
Bone and Super., No. 1 ...	Binney & Son	Swan	...	...	...	...	1·37	...	...	17·65	17·65	...	...	6 10 0
Bone and Super., No. 2 ...	do.	do. ...	...	...	...	...	·75	...	...	11·89	11·89	...	...	5 0 0
Bone and Super., No. 1 ...	D. F. Carbarns & Co. ...	Crown	...	...	...	...	1·37	8·0	...	9·65	17·65	...	...	6 10 0
Blood, Bone and Super. ...	Cuming, Smith-Mt. Lyell Farmers' Fertilisers, Ltd.	CSML	...	...	...	2·0	...	13·0	·8	4·7	18·5	...	...	7 9 0
Do. do. ...	do. do. do.	ML in diamond		...	...	2·0	...	13·0	·8	4·7	18·5	...	...	7 9 0
Do. do. ...	do. do. do.	Sickle	...	...	...	2·0	...	13·0	·8	4·7	18·5	...	...	7 9 0
Orchard Fertiliser	Paterson & Co., Ltd. ...	Patco	...	...	...	5·0	...	...	...	12·0	12·0	...	...	12 10 0
(b) Nitrogen, Phosphoric Acid and Potash.														
Bone, Super., Potash ...	Binney & Son	Swan	...	...	...	1·0	...	...	..	14·0	14·0	1·0	...	5 10 0
Do. do.	D. F. Carbarns & Co. ...	Crown	...	...	...	1·0	...	...	...	14·0	14·0	1·0	...	5 10 0
Orchard Fertiliser (Bone), No. 2	Binney & Son	Swan	...	...	...	3·17	...	...	...	10·0	10·0	5·0	...	12 0 0
Special Potato (Bone), B ...	do.	do. ...	...	...	...	3·0	...	...	...	15·0	15·0	2·25	...	9 10 0

* Prices not yet available.

A NEW STRAIN OF EARLY SUBTERRANEAN CLOVER.

A. B. ADAMS, B.Sc. (Agric.).

During this season a strain of subterranean clover that is new to the writer was noted on the Northam golf links.

From the evidence of observers it has been noticed to be spreading, but it was not realised that it was an early variety of a different type to any so far reported.

On whatever part of the links subterranean clover was seen, the plants were similar; it may therefore be inferred that they are all descended from one original plant.

No information is obtainable to show if subterranean clover seed were ever sown; if it were, one type only has survived; if it were not, then grazing stock were the most probable means of introducing a strain suited to the conditions.

The soil of the paddock is a heavy loam that has set down very hard and neither has been cultivated nor top-dressed for a considerable period, hence the plant has had but little encouragement.

The variety may be described as being more like the ordinary midseason variety than the early varieties previously recognised, as it has a light red calyx, lighter than that of the Daliak strain, and a light mark in the leaf which is absent from that variety. There was no means of judging its comparative size as it has been heavily stocked all season to keep the grass short, and the lack of top-dressing does not favour luxuriant growth. It was in flower from the third week in August, and if propagated is therefore likely to prove a useful pasture plant for those districts that have a rainfall similar to that of Northam.

A few of the plants were protected late in the season in the hope of obtaining information as to their seeding habits, but it proved to be too late for the purpose. Next season it is hoped to obtain further information by fencing off a few plants and fertilising them early in the season.

CAPE GOOSEBERRY (Physalis peruviana).

GEO. W. WICKENS,
Superintendent of Horticulture.

Suggestions have been made that Cape Gooseberries would be a profitable side line for group and other settlers in the South West, and there is no question that a ready sale is obtainable on the local markets where good quality fruit of this kind is often not available in sufficient quantities to meet the demand.

On the coastal lands where the sea influence prevents heavy frosts, fruit is produced throughout the greater portion of the year, but in the hills near Perth, and in districts further south where winter frosts are prevalent, very little fruit is harvested during the winter months.

The plants are easily propagated, seeds being sown in beds or boxes like tomatoes, in Autumn and transplanted in Spring They must be protected from frost in the seed beds or boxes during the winter and after transplanting should be sheltered by pieces of bush until damage from frost is no longer apprehended. 7ft. x 7ft. on the square is a suitable distance apart, and an acre of land so planted will contain 889 plants.

A fair average production per plant per annum is 4 lbs. of fruit and the price in the Perth market ranges from 4d. to 8d., say an average of 6d. per lb.; so that from an acre of land a gross return of 3,556 lbs. at 6d., or £89, could be expected.

One big expense in connection with production is gathering the fruit, an average day's work for one person being 40 lbs., but where the settler is assisted by a family, boys and girls will operate as speedily and quite as effectively as adults, and the occupation, though somewhat tedious, is not laborious.

In Autumn the plants should be cut hard back and the new growths which shoot out from the crown after the advent of the seasonal rains produce fruit during the following Spring and early Summer. Profitable crops will be gathered for three to four years, after which the plantation needs renewing, and new land, that is, land on which Cape Gooseberries have not previously been grown, must be chosen for the purpose. A deep rich loamy soil, moist in summer and well drained in winter, is ideal, but where this is not available, quite successful plantations can be established on poorer land either of a gravelly or sandy nature, provided cultivation and manurial requirements receive proper attention. Liberal dressings of stable manure will give excellent results, but this is not often obtainable in sufficient quantities, and combined fertilisers that are sold as potato manures are quite suitable for Cape Gooseberries, the quantity to be applied being governed by the nature of the soil, and may range from 4 cwts. to 10 cwts. per acre, to be applied in two dressings, half in April and half in August.

The worst insect pest affecting Cape Gooseberry plants in this State is the Potato Moth and when setting out the plantation care must be taken not to place it near land on which potatoes have recently been grown, particularly where tubers affected with Moth have been allowed to remain in the ground.

If potato moths are present the method of guarding against their attack is to spray the plants with Arsenate of Lead, using 1½ lbs. of powdered or 3 lbs. of paste in 50 gallons of water, and 1 lb. flour added to form a spreader.

This treatment is only effective before the caterpillars tunnel into leaves or stems, after tunnelling the remedy lies in cutting out and destroying the infected portions.

Red Spider and Bryobia mites are also troublesome. These can be controlled by applications of sulphur either dry or as atomic (liquid). Should the pest be present when fruit is ripening sulphur may be replaced by "Clensel" —a non-poisonous spray material which can be used for this purpose at a strength of 1 in 25.

PASTURE COMPETITION.

Kojonup Agricultural Society.

G. GAUNTLETT, B.Sc.(Agric.),
Agricultural Adviser.

This competition, conducted by the above Society, attracted five entrants, viz., Messrs. Cavanagh, Piesse (2), Webb, and Eulin Pastoral Company.

The following table shows the points gained by each competitor:—

Competitor.	Quality.	Yield.	Clover Content.	Freedom from Weeds.	Total.
	35	25	20	20	100
Cavanagh	33	25	19	19	96
H. Piesse (2)	32	22	18	18	90
J. Webb	31	16	18	18	83
Eulin Pastoral Company ...	30	16	17	15	78
H. Piesse (1)	29	14½	16	17	76½

Another stand.

The winning five acres was a remarkably good clover yield. The plot was very even, and consisted of a mixture of subterranean and suckling clovers with a little hop clover. The pasture was 12-15 inches high, and was practically free from weeds. The plot also was almost free from red mite.

Mr. Cavanagh's farm is at Muradup, and, as this district has an average rainfall approximately 2 inches greater than Kojonup, he had a slight advantage over the other competitors.

The pasture was top-dressed in May, and again during the first week in September, with 90 lbs. Cresco superphosphate per acre. It was grazed with sheep until the end of June, and then with cattle up to the end of September.

A good stand of Subterranean Clover grown by Mr. H. Piesse, Kojonup.

The competitor gaining second place, Mr. H. Piesse, had a good plot of subterranean clover. This entry was also very free from weeds, but unfortunately there were a few bare patches in the plot which necessarily reduced the yield.

The other entries, while being good, had more weeds, suffered more from the attacks of the red mite, and had not made the growth of the first and second entries.

All plots were top-dressed twice.

The following table gives the estimated yields per acre of the different entries, both green material and hay:—

Plot.	Green Material.				Hay (calculated).			
	tons	cwt.	qrs.	lbs.	tons	cwt.	qrs.	lbs.
Cavanagh	10	16	0	8	2	3	0	7
H. Piesse (2)	9	10	0	16	1	18	0	3
J. Webb	6	18	1	4	1	3	2	17
Eulin Pastoral Company	6	18	1	4	1	3	2	17
H. Piesse (1)	6	5	1	8	1	5	0	7

In calculating the weight of hay I assumed that 20 lbs. of hay would be obtained from 100 lbs. green material.

Making of Clover Hay.

The best time to cut subterranean clover hay is a little after the full bloom, when the plant has had a chance to send down a good stand of seed. More often than not, clover hay is cut too late.

If carting cannot be commenced immediately, the hay should be heaped into "cocks." If carting can be proceeded with at once, the hay can be raked into windrows, left exposed to the sun for 12 to 24 hours, and then carted to the stack. It must be remembered that the dryer the hay, the more brittle it becomes, and a subsequent heavier loss of the leaves—the most nutritious portion—is entailed.

It is not advisable to mow the same paddock twice in succession. Subterranean clover is an annual, and a good opportunity must be given for the plant to re-seed.

In the drier portions of the State, subterranean clover hay may be made into stacks, but in the wetter portions it is probably better to cure the hay in sheds.

It is not necessary to chaff the hay; stock like it just as well long. With dairy cows, long hay would also assist in rumination.

CRANBROOK PASTURE COMPETITIONS, 1930.

Judge—A. S. WILD, B.Sc.(Agric.),
Agricultural Adviser.

This year the Cranbrook Agricultural Society conducted two pasture competitions, one for pastures established for less than 12 months and the other for those established over two years.

In the first competition only one entry, that of Mr. E. Theyer, was received, and this was accordingly awarded first prize.

Mr. Theyer's entry was on land which had been cropped once previously. The pasture had been established on fallow by broadcasting clover burr together with 50 lbs. of barley and 90 lbs. of superphosphate per acre during March, 1930. It had been grazed heavily with horses and sheep from the end of April until the middle of August. A few sheep had been depastured on the land until the middle of September.

The awards made in the second class for pastures established over two years are as follow:—

Competitor.	Yield. 45 pts.	Freedom from Weeds. 15 pts.	Useful Grasses. 15 pts.	Freedom from Diseases. 15 pts.	Evenness of Growth. 10 pts.	Total. 100 pts.
T. R. Lewis	45	13	14	14	9	95
E. Theyer	40	12	13	14	8	87
T. H. Hall	35	13	14	13	8	83
D. E. Morgan ...	33	13	14	14	8	82
E. Theyer	33	11	13	14	7	78
H. E. Clappin ...	25	13	14	14	8	74

The rainfalls as recorded at Cranbrook during the year from April up to the 27th October are as hereunder:—

April	May	June	July	Aug.	Sept.	To Oct. 27th	Total growing period.
93	381	415	317	129	188	73	·15·96 inches.

Mr. T. R. Lewis secured first place with a very good pasture plot composed almost entirely of subterranean clover. The land, which has been cleared for about six years, originally carried jarrah, red gum and white gum timber. It had been ploughed during the autumn of 1925 and sown with oats, together with 2 lbs. of subterranean clover seed per acre. Superphosphate was applied at the rate of 90 lbs, per acre, this dressing being repeated in the autumn and again in the spring of each succeeding year. This pasture had been fed off by sheep until the 1st of August. At the tie of inspection (27th October) it was calculated to yield approximately 11 tons per acre of green growth.

Mr. E. Theyer's entry, which secured second place, was on land which was cleared of its original timber (white gum and wattle) about 10 years ago. Subterranean clover seed at the rate of 2 lbs. per acre was sown during the autumn of 1928, after the land had been disc-cultivated. At the time of sowing, superphosphate was applied at the rate of 60 lbs. per acre, this being followed by a dressing of 90 lbs. per acre in 1929 and another of 60 lbs. per acre during July, 1930. This plot, which was calculated to yield approximately 9 tons per acre, had been heavily stocked up to July of this year.

Mr. T. H. Hall's pasture was on jarrah and white gum country. This land had been fallowed with a mouldboard plough during 1926, and, in the following March, sown with one bag of subterranean clover burr and 2 lbs. of rape per acre, together with 112 lbs. of superphosphate. Each year an autumn top-dressing of 90 lbs. per acre of superphosphate was applied. In the autumn of 1928 yellow suckling clover and drooping flowered clover were sown at the rate of 2 lbs. per acre with the superphosphate. An additional 90 lbs. of this fertiliser was also applied to each acre during the spring of this year. The plot had been heavily fed off with stock up to the end of August.

The pasture entered by D. E. Morgan, on open white gum country, had been established about four or five years. Two lbs. of subterranean clover and ½ lb. of Wimmera rye grass were sown on fallowed land together with 90 lbs of superphosphate per acre. Each autumn the pasture has been top-dressed with 45 lbs. of

superphosphate per acre, and an additional 45 lbs. per acre was applied during the spring of this year. The pasture had been grazed until the middle of August.

Mr. E. Theyer's second entry had been prepared in a similar manner.

Mr. H. E. Clappin's pasture was on yate and flooded gum country. It had been harrowed and top-dressed with 90 lbs. of superphosphate per acre during March, 1930.

WEST ARTHUR PASTURE COMPETITION, 1930.

Judge—A. S. WILD, B.Sc.(Agric.),
Agricultural Adviser.

This competition was held under the auspices of the West Arthur Agricultural Society. The competing pastures were inspected on the 22nd October. The monthly rainfalls for 1930, up to that date, as registered at Darkan, are given below:—

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.
Nil	25	48	125	217	653	770	214	243

Awards were made as follows:—

Competitor.	Yield. 45 pts.	Freedom from Weeds. 15 pts.	Useful Grasses. 15 pts.	Freedom from Disease. 15 pts.	Evenness of Growth. 10 pts.	Total. 100 pts.
E. L. Walker ...	40	13	12	13	9	87
A. C. Cummings ...	38	13	12	13	8	84
H. C. Pobjoy ...	30	13	12	11	7	73

Mr. E. L. Walker's winning pasture plot was on a sandy Wandoo flat with clay subsoil. The land had been cleared seven or eight years previously. This pasture was established about six years ago after a crop of Sudan grass. Subterranean clover seed was planted on the ploughed land at the rate of 5 lbs. per acre, superphosphate being applied at the rate of 90 lbs. per acre. This dressing of fertiliser has been repeated during the April of each succeeding year. In addition, the plot received a further top-dressing of 90 lbs. of superphosphate per acre during the spring of 1929, and one of 60 lbs. per acre during the spring of 1930.

Mr. A. C. Cumming's pasture was also on a Wandoo flat, being on land which had been re-cleared four years ago. This pasture was established by sowing ¾ lb. of subterranean clover with 90 lbs. of superphosphate per acre on land which had previously been skim-ploughed. During the autumn of 1928 it was top-dressed with superphosphate at the rate of 80 lbs. per acre, followed by further dressings of 120 lbs. in 1929 and 60 lbs. in 1930. Immediately after the last top-dressing the land was scarified.

Mr. H. C. Pobjoy's entry was a pasture established on a red gum flat. It had been established six years previously by sowing ½ lb. of subterranean clover per acre under cover of oats and rape. During the autumn of each subsequent year it was top-dressed at the rate of 80 lbs. of superphosphate per acre. Additional top-dressings were also applied during the spring in 1929 and 1930.

THE NEW BEES ACT.

H. Willoughby Lance,
Apiculturist.

After many years of effort by the Beekeepers' Association, a new Act dealing with the control of Apiaries has passed through Parliament and will come into effect shortly. It may be well to briefly describe here how it will affect the industry.

The objects of the Act are to improve the industry, also to protect the commercial apiarists against the careless or ignorant beekeeper. Unfortunately there are a number of persons who like to see a hive of bees on their premises, but have no knowledge of how to handle them or of any disease that may attack them. There are many infectious diseases which attack bees and the most serious of these are dealt with in the Act.

"Apiary."—The Act provides that an apiary includes any place where bees or appliances are kept. This of course means that if one hive of bees is kept, the beekeeper will come under the Act. Also, if there are any appliances such as old unused hives, these will also come under the Act, the reason being that one hive may become diseased or the old empty hives may have become empty on account of disease and it may be necessary to inspect these.

"Beekeeper"—means any person who keeps bees or the person in charge of bees or a person who allows bees to be kept on any land occupied by him, or who is the owner of or has in his possession or allows to be kept on any land owned or occupied by him any appliances that have been used in connection with apiculture. This definition has the same object in view as the first, namely, to bring under the purview of the Department of Agriculture all places where bees or appliances of any description are kept. If the owner of any land allows a person to place bees thereon, he is responsible either to see that that beekeeper registers the apiary site or to do so himself.

Registration.—The registration of every beekeeper is provided for. The registration fee has been fixed at 1s. for 10 hives or less, and 2s. 6d. for over 10 hives. Application for registration to be made to the Director of Agriculture. Penalty for non-compliance, £5.

Disease.—It is obligatory for any beekeeper who discovers disease amongst his bees to immediately notify the Department of Agriculture, and to take steps to cure or eradicate the disease. It is also an offence for any person who has infected bees or appliance, to sell, barter, give away or otherwise dispose of them in such a manner as shall be prescribed.

The Act gives power to an officer of the Department of Agriculture to enter and inspect any apiary, bees, appliances, etc., and exonerates him from being deemed a trespasser or made liable for any damage, unless such damage is occasioned wilfully and without necessity. If it becomes necessary to have any bees, hives, etc., destroyed, the owner cannot claim any compensation in respect to any damage that may result to him therefrom unless the destruction was occasioned wilfully and without necessity.

The powers of an officer to deal with disease are also defined, and he has the power, if necessary, to have any bees or hives destroyed within a specified time. Should the beekeeper fail to carry out these instructions the Department of Agriculture, with the approval of the Director, may carry out the work at the beekeeper's expense.

Proclamations.—Any area that becomes seriously infected with diseases may be declared an infected area, in which case bounds will be set to that area from which no bees or appliances may be removed. Also any district may be proclaimed a district in which only a specified type of hive may be used.

Hives.—The Act deals with hives which are in such a condition that the combs cannot be separately and readily removed from the hive for examination without cutting the comb, and includes not only box hives in which the combs are attached to the box by the bees, but also frame hives which have cross combs or badly built combs so that each separate comb cannot be removed without cutting. It also covers broken and ant-eaten hives which are in such a condition that they cannot be handled for inspection. It gives the officer power to have the bees removed from these hives within a specified time and placed in satisfactory hives.

The greater and lesser Wax Moth are also dealt with, and an officer has power to have any bees or hives infected with these pests disinfected or destroyed as may be necessary.

Importations.—An important clause is one that is designed to prevent the bringing into the State of any infectious material. Although we have Foul Brood disease in Western Australia at the present time, there are only a few districts which are affected, and so far as is known at present, there is no Acarine Disease. This clause provides that—

> "No person shall introduce into the State, either by land, sea, or air, any bees, hives, honey, or beekeepers' appliances that have been used in connection with beekeeping, unless accompanied by a certificate in writing as prescribed from a Government apiculturist or the Department of Agriculture in the country or State of origin, certifying that such bees, hives, honey or appliances come from a district in which Foul Brood (Bacillus larvae, Bacillus pluton, or Bacillus alvei), and Isle of Wight Disease (Acarine Disease), do not exist."

It must be noted that in this clause any bees, hives or appliances that have been used for beekeeping must be accompanied by a certificate of cleanliness before they can be introduced into the State.

Honey is also included in this clause and it means that no honey may be imported into Western Australia from a district in which Foul Brood exists. As most beekeepers are aware, honey is a great carrier of the spores of Foul Brood, and there is no doubt in the minds of leading scientists and beekeepers that this foul disease is spread by the passage of honey from one district to another. Very often empty containers are thrown out and cleaned up by the bees, and if the honey comes from a diseased hive the spores causing the disease are carried into the hives and may easily start a serious epidemic. There are many districts in this State in which Foul Brood is not at present known to exist, and the object of this clause is to prevent infected honey being brought into the State, the empty containers of which might be thrown out in clean districts. It may here be noted that the French Ministry of Agriculture has just promulgated an order that the importation of bees, etc., is only permitted if accompanied by a certificate of good health. This applies also to honey.

Penalties.—It will be an offence for any person to obstruct or impede an officer in the execution of his powers under this Act; or to fail to comply with the provisions of the Act, or to furnish such information as may be necessary, the penalty being Twenty pounds.

Power is also given to the Department of Agriculture to carry out any necessary work which the beekeeper fails to do, at the expense of the beekeeper, and provides for the recovery of such expenses in a court of law.

Regulations may be made for the carrying out of the Act and for the inspection of honey houses, etc.

As regards diseases, there are many beekeepers that have had no experience with these, who should make themselves acquainted with the symptoms. An article on Bee Diseases appeared in the "Agricultural Journal" for March, 1929, which has been reprinted in leaflet form, a copy of which may be obtained on application.

TOBACCO INVESTIGATIONS, 1929-30.

[The following article is an extract from the Annual Report of the Officer in Charge of Irrigation (Mr. A. R. C. Clifton) and refers to the progress of the work conducted co-operatively by the W.A. Department of Agriculture and the Australian Tobacco Investigation. The field work in connection with the tests reported on was carried out by Mr. H. J. Limmer on his property at Manjimup.—Ed.]

The work undertaken during 1929-30 comprised the following:—

Project No. 3: Seeding Tests to determine the best date for sowing seed beds.

Projects 5 and 8: Seasonal Variety Trial, to determine the most favourable date for transplanting in the field and to determine which of the flue-cured varieties are best adapted to West Australian conditions.

Project 23: Production of disease-free seed.

Project 24: Fertiliser Trial.

Project No. 3.

Seed beds were planted on the following dates:—

No. 1	...	8th July	...	Under glass
,, 2	...	18th July	...	do.
,, 2A	...	1st August	...	do.
,, 3	...	19th August	...	do.
,, 4	...	31st August	...	do.
,, 5	...	6th Sept.	...	do.
,, 6	...	23rd Sept.	...	do
,, 7	...	25th Sept.	...	calico covered
,, 8	...	11th Oct.	...	do.
,, 9	...	11th Oct.	...	do.

comprising in all 85 sq. yards.

The heating material used in No. 1 seed bed was green manure. This was not satisfactory, and stable manure, which was found to give a temperature of from 5° to 10° higher, was used in No. 2 and subsequent beds up to the middle of September.

On account of the failure of No. 1 seed bed to germinate and come away quickly, No. 2 seed bed had to be relied on for the first planting, which was planned to commence in the beginning of September.

To get the plant along in time it was therefore decided to endeavour to prevent the drop of the night temperature in this seed bed by placing under the glass frame and across the surface of the bed a length of 2in. galvanised iron down piping through which hot air was circulated every night from an oil lamp outside the frame, somewhat on the principle of the flue in a curing barn. Mr. Limmer, in the latter part of winter, was thus able to have plants in the field seven weeks after sowing in the seed bed.

The seed-bed results are shown in the following table:—

Seed-bed.	Date Sown.	Type.	Soil.	Date Germinated.	Date ready to Plant out.
No.					
1	8 July	Hot bed under glass	Black sand	25 July (17 days)	21 Sept. (75 days)
2	18 July	do. do.	do.	25 July (7 days)	5 Sept. (49 days)
2A	1 Aug.	do. do.	do.	10 Aug. (9 days)	30 Sept. (60 days)
3	19 Aug.	do. do.	do.	28 Aug. (9 days)	16 Oct. (58 days)
4	31 Aug.	do. do.	do.	9 Sept. (9 days)	1 Nov. (61 days)
5	6 Sept.	Calico covered, 16th glass covered	do.	21 Sept. (15 days)	9 Nov. (64 days)
6	23 Sept.	Cold frame under glass	do.	4 Oct. (11 days)	19 Nov. (57 days)
7	25 Sept.	Cold frame, calico covered	do.	4 Oct. (9 days)	19 Nov. (55 days)
8	11 Oct.	do. do.	do.	21 Oct. (10 days)	1 Dec. (51 days)
9	11 Oct.	do. do.	do.	21 Oct. (10 days)	1 Dec. (51 days)

Projects 5 and 8.

This test was carried out on well-drained light sandy loam, having a gentle slope with an easterly aspect (karri and redgum country).

Portion of the area was used for the previous season's tobacco trial, but the larger portion (plots 1 to 140) had been down in subterranean clover for several years.

At the end of July the land was ploughed 8 inches deep and left in the rough until the end of August, when it was cross-ploughed and disc-cultivated.

The fertiliser used was as follows:—

100 lbs. Sulphate of Ammonia.
50 lbs. Nitrate of Soda.
600 lbs. Superphosphate.
100 lbs. Sulphate of Potash.

and was applied by hand at the rate of 1,000 lbs. per acre along an open furrow and then covered with a plow from each side and levelled off.

One-hundredth acre plots were laid out in single rows 42 inches apart; each plot contained 75 plants, which were set at 20-inch intervals in the row.

Planting in the field was carried out at fortnightly intervals, as follows:—

1st planting	5th September.
2nd planting	18th September.
3rd planting	2nd October.
4th planting	16th October.
5th planting	30th October.
6th planting	13th November.
7th planting	27th November.
8th planting	11th December.

The varieties intended to be used for each planting (in triplicate) were Hickory Pryor, Warne, Adcock, Conqueror and White Stem Orinoco, with Dungowan as control. Unfortunately, however, the Conqueror plants were not ready until the second planting on the 18th September, and White Stem Orinoco was not ready until the third planting on the 2nd October.

The average yield per acre and percentage of bright leaf of all plots in each planting were as follow:—

First planting ...	Sept. 5th ...	1,521lbs. cured leaf ...	57·7 per cent. bright.
Second planting ...	Sept. 18th ...	1,322 ,, ,, ,, ...	66·2 ,, ,,
Third planting ...	Oct. 2nd ...	1,165 ,, ,, ,, ...	57·3 ,, ,,
Fourth planting ...	Oct. 16th ...	1,186 ,, ,, ,, ...	63·8 ,, ,,
Fifth planting ...	Oct. 30th ...	1,069 ,, ,, ,, ...	54·3 ,, ,,
Sixth planting ...	Nov. 13th ...	521 ,, ,, ,, ...	1·0 ,, ,,
Seventh planting ...	Nov. 27th ...	498 ,, ,, ,, ...	0·0 ,, ,,
Eighth planting ...	Dec. 11th ...	532 ,, ,, ,, ...	3·6 ,, ,,

It will be noted that excellent yields were obtained up to the fifth planting on 30th October, while the yields of the last three plantings were 50 per cent. less. This is accounted for by the dry weather and difficulty of getting the plants to strike, resulting in a large percentage of misses.

The absence of bright leaf in the later plantings would be due to the poor growth and the necessity for having to plant harvest a large amount of immature leaf on account of field fire and the risk of heavy rain due to the lateness of the season.

The following table shows the percentages of bright leaf and yield of each variety in the first five plantings, and is a truer indication of the bright leaf procurable:—

Variety.	No. times in expt.	Yield.	Bright.	Dark.
		per cent.	per cent.	per cent.
Hickory Pryor	15	94·9	73	27
White Stem Orinoco ...	9	94·8	72·9	27·1
Adcock	15	95·2	67·4	32·5
Conqueror	12	84·3	70·9	29·1
Warne	15	96·5	53	47
Dungowan (Control)	42	100	29·2	70·8

Full details of the plot yields will be found set out in Table No. 1, and the percentages of bright leaf and yield of the different varieties are set out in Table No. 2.

Project No. 23—Production of disease-free seed.

Three-quarters of an acre of tobacco comprising the following 16 varieties:—

Warne	Flannagan
Hickory Pryor	Hester
Conqueror	Big Orinoco
White Stem Orinoco	Little Orinoco
Adcock	Lizzard Tail
Yellow Pryor	Gold Leaf
Cash	Dungowan
Long Leaf Gooch	Spotted Gum

were grown for the seed requirement of the Australian Tobacco Investigation. 42¾ lbs. of cleaned, graded and tested seeds were forwarded to Melbourne.

The decision to have a special seed plot was arranged after plans had been made for the season's operations, and unfortunately the only land available for this purpose turned out to be too wet on account of the wet November to get on to until December, and consequently the seed plants were late in reaching maturity.

In future, seed plants will be put out early in the season to avoid the harvesting of the seed, etc., clashing with the grading and sorting of the leaf.

Project No. 24—Fertiliser Trial.

Ten one-hundredth acre plots of Spotted Gum were planted on 25th October. Five of these plots had the complete fertiliser, while the balance had the same amounts of superphosphate and potash, but no nitrogen.

The results were as follow:—

Complete Fertiliser.

Yield per acre Cured Leaf.	Bright.	Dark.
	per cent.	per cent.
880 lbs.	30	70

Non-nitrogenous Fertiliser.

Yield per acre Cured Leaf.	Bright.	Dark.
	per cent.	per cent.
790 lbs.	29·74	70·26

The absence of nitrogen appeared to make no difference to the percentage of bright leaf, but decreased the total yield by 90 lbs. per acre as compared with the plots treated with the complete fertiliser. It was noted, however, that the nitrogen plots were more subject to field fire than the others. The top end of all these plots made very poor growth on account of the land drying out, so that the test was not a satisfactory one. Spotted Gum is a similar variety to Dungowan, and the percentage of bright leaf would have been much higher had a more suitable variety such as Hickory Pryor or White Stem Orinoco been used.

General.

The outstanding features of this year's tobacco experiments were the splendid results of the early plantings.

In this connection, however, it is necessary to draw attention to the unusually favourable distribution of the rainfall up to the end of December, which undoubtedly would have a large bearing on the heavy yields obtained.

September and August at Manjimup are very often wet and cold months, and would not be good growing weather for tobacco. This season, however, the rainfall was below the average for these two months, so that the soil conditions in September were more favourable than they would be normally.

The October rainfall was below the average, but the rainfalls for November and December were 247 and 121 points, respectively, above average.

The rainfall, on the other hand, fell away after December and was well below the average for the rest of the growing period, which would account for the falling-off of the yields of the later planted plots.

The Manjimup rainfall data is set out below:—

Year.	Month.	Rainfall.	Average (14 years).
1929	August	451	632—181 points below average.
,,	September	300	502—202 ,, ,, ,,
,,	October	294	380— 86 ,, ,, ,,
,,	November	423	176—247 points above average.
,,	December	221	100—121 ,, ,, ,,
1930	January	19	104— 95 points below average.
,,	February	19	120—101 ,, ,, ,,
,,	March	107	126— 19 ,, ,, ,,
,,	April	153	256—103 ,, ,, ,,

The foregoing indicates the importance of continuing these tobacco trials and collecting data over a number of seasons.

Another interesting feature was the large percentage of bright leaf obtained from the heavy yields on old clover land. It would seem as if the Manjimup land does not have too much nitrogen for the production of bright leaf. The results of the tests of the smoking and general qualities of the leaf, however, may throw further light on this point.

The best varieties for amount of bright leaf produced were Hickory Pryor, White Stem Orinoco and Adcock.

It was unfortunate that White Stem Orinoco was not included in the first two plantings. The possibilities of this variety are indicated, however, in the fifth planting, where 91 per cent. of bright leaf was obtained.

The leaf has all been despatched to Melbourne, where it will be aged and smoking tests will be carried out under the personal supervision of Mr. C. M. Slagg, the Director of the Australian Tobacco Investigation.

TABLE No. 1—PROJECT No. 5 AND 8.

Seasonal Variety Test—1/100 acre Plots, Control—" Dungowan."

MANJIMUP.

Section.	Plot No.	Variety: Dungowan.	Plot No.	Variety: Hickory Pryor.	Plot No.	Variety: Warne.	Plot No.	Variety: Dungowan.	Plot. No.	Variety Adcock.	Plot No.	Variety: Conqueror.	Plot No.	Variety: Dungowan.	Plot No.	Variety: White Stem Orinoco.	Plot Totals.	Plot Means.
								First Planting—5th September.										
		lbs.		lbs.		lbs.		lbs.		lbs.		lbs.		lbs.		lbs.	lbs.	lbs.
1	1	1,950	2	1,500	3	1,600	4	1,925	5	1,575	...	...	...	...	...	...	8,550	1,710
2	61	2,000	62	1,550	63	1,100	64	1,525	65	1,375	...	...	...	...	...	...	7,550	1,510
3	121	1,500	122	1,300	123	1,325	124	1,350	125	1,250	...	...	...	...	...	...	6,725	1,345
Sum ...	...	5450	...	4,350	...	4,025	...	4,800	...	4,200	...	...	...	...	...	...	...	4,565
Mean ...	...	1,816	...	1,450	...	1,341	...	1,600	...	1,400	...	...	...	...	...	...	...	1,521
Per cent.	...	100	...	79·8	...	83·8	...	100	...	87·5	...	...	...	...	...	...	...	...
								Second Planting—18th September.										
1	6	1,700	7	1,400	8	1,275	9	1,800	10	1,475	11	1,000	12	1,225	...	...	9,875	1,410
2	66	1,150	67	1,500	68	1,600	69	1,175	70	1,400	71	1,375	72	1,600	...	...	9,800	1,400
3	126	1,150	127	1,125	128	1,175	129	1,275	130	1,175	131	1,100	132	1,075	...	...	8,095	1,156
Sum ...	...	4,000	...	4,025	...	4,050	...	4,250	...	4,050	...	3,475	...	3,900	...	...	...	3,966
Mean ...	...	1,333	...	1,341	...	1,350	...	1,416	...	1,350	...	1,158	...	1,300	...	...	...	1,322
Per cent.	...	100	...	100·6	...	95·3	...	100	...	95·3	...	89·00	...	100	...	...	...	...
								Third Planting—2nd October.										
1	13	1,625	14	1,350	15	1,075	16	1,400	17	925	18	1,050	19	1,575	20	1,150	10,150	1,268
2	73	1,375	74	1,300	75	1,225	76	1,300	77	1,275	78	1,100	79	1,500	80	1,050	10,125	1,265
3	133	750	134	900	135	800	136	1,225	137	975	138	950	139	1,150	140	950	7,700	962
Sum ...	...	3,750	...	3,550	...	3,100	...	3,925	...	3,175	...	3,100	...	4,225	...	3,150	...	3,495
Mean ...	...	1,250	...	1,183	...	1,033	...	1,308	...	1,058	...	1,033	...	1,408	...	1,050	...	1,165
Per cent.	...	100	...	94·6	...	79	...	100	...	80·8	...	73·3	...	100	...	74·5	...	...

Fourth Planting—16th October.																		
1	21	1,300	22	1,125	23	1,500	24	1,150	25	1,500	26	1,000	27	1,275	28	1,700	10,550	1,318
2	81	1,075	82	1,125	83	1,125	84	1,150	85	1,150	86	1,025	87	1,050	88	925	8,625	1,078
3	141	825	142	1,000	143	1,050	144	1,200	145	1,225	146	1,250	147	1,375	148	1,375	9,300	1,162
Sum ...	...	3,200	...	3,250	...	3,675	...	3,500	...	3,875	...	3,275	...	3,700	...	4,000	...	3,558
Mean ...	...	1,066	...	1,083	...	1,225	...	1,166	...	1,291	...	1,091	...	1,233	...	1,333	...	1,186
Per cent.	...	100	...	101·5	...	105	...	100	...	110·7	...	88·4	...	100	..	108	...	...
Fifth Planting—30th October.																		
1	29	1,300	30	1,050	31	1,000	32	975	33	825	34	1,000	35	1,400	36	1,375	8,925	1,115
2	89	850	90	950	91	850	92	500	93	900	94	925	95	1,000	96	1,050	7,025	878
3	149	1,175	150	1,175	151	1,000	152	1,325	153	1,125	154	1,275	155	1,300	156	1,350	9,725	1,215
Sum ...	...	3,325	...	3,175	...	2,850	...	2,800	...	2,850	...	3,200	...	3,700	...	3,775	...	3,208
Mean ...	...	1,108	...	1,058	...	950	...	933	...	950	...	1,066	...	1,233	...	1,258	...	1,069
Per cent.	...	100	...	98·4	...	101·8	...	100	...	101·8	...	86·4	...	100	...	102	...	...
Sixth Planting—13th November.																		
1	37	625	38	500	39	475	40	750	41	375	42	500	43	625	44	625	4,475	559
2	97	525	98	475	99	450	100	525	101	?	102	475	103	400	104	500	3,350	477
3	157	450	158	500	159	700	160	350	161	525	162	675	163	650	164	375	4,225	528
Sum ...	...	1,600	...	1,475	...	1,625	...	1,625	...	900	...	1,650	...	1,675	...	1,500	...	1,565
Mean ...	...	533	...	491	...	541	...	541	...	450	...	550	...	558	...	500	...	521
Per cent.	...	100	...	92	...	100	...	100	...	83	...	98·5	...	100	...	89·6	...	...
Seventh Planting—27th November.																		
1	45	825	46	525	47	500	48	725	49	525	50	575	51	600	52	450	4,725	590
2	105	550	106	350	107	250	108	550	109	350	110	325	111	525	112	275	3,175	396
3	165	525	166	450	167	475	168	650	169	575	170	325	171	700	172	375	4,075	509
Sum ...	...	1,900	...	1,325	...	1,225	...	1,925	...	1,450	...	1,225	...	1,825	...	1,100	...	1,495
Mean ...	...	633	...	441	...	408	...	641	...	483	...	408	...	608	...	366	...	498
Per cent.	...	100	...	69·6	...	63·6	...	100	...	75·3	...	67	...	100	...	60·1	...	...
Eighth Planting—11th December.																		
1	53	900	54	550	55	725	56	875	57	700	58	525	59	700	60	525	5,500	686
2	113	450	114	400	115	375	116	375	117	275	118	325	119	500	120	200	2,900	362
3	173	625	174	450	175	650	176	575	177	425	178	450	179	650	180	575	4,400	550
Sum ...	...	1,975	...	1,400	...	1,750	...	1,825	...	1,400	...	1,300	...	1,850	...	1,300	...	1,598
Mean ...	...	658	...	466	...	583	...	608	...	466	...	433	...	616	...	433	...	532
Per cent.	...	100	...	70·8	...	95·8	...	100	...	76·6	...	70	...	100	...	70	...	...

The figures in the variety column are the yields per acre in pounds of cured leaf.

TABLE No. 2.—PROJECT 5 AND 8.

Percentages of Yield and Bright Leaf.

Date of Planting.	Hickory Pryor.		White Stem Orinoco.		Adcock.		Conqueror.		Warne.		Dungowan (Control).		Bright.	
	Yield.	Bright (Lemon and Orange).	Yield.	Bright (Lemon and Orange).	Yield.	Bright (Lemon and Orange).	Yield.	Bright (Lemon and Orange).	Yield.	Bright (Lemon and Orange).	Yield.	Bright (Lemon and Orange).	Sum.	Mean.
	%	%	%	%	%	%	%	%	%	%	%	%		%
Sept 5	79·8	73	...	...	87·5	70	...	...	83·8	46	100	42	231	57·7
Sept. 18	100·6	79	...	...	95·3	67	89	68	95·3	68	100	49	331	66·2
Oct. 2	94·6	81	74·5	54	80·8	67	73·3	60	79	46	100	36	344	57·3
Oct. 16	101·5	80	108	74	110·7	70	88·4	83	105	67	100	9	383	63·8
Oct. 30	98·4	53	102	91	101·8	61	86·4	73	101·8	38	100	10	326	54·3
Nov. 13	92·0	0	89·6	0	83	6	98·5	0	100	0	100	0	6	1
Nov. 27	69·6	0	60·1	0	75·3	0	67	0	63·6	0	100	0	0	0
Dec. 11	70·8	7	70	15	76·6	0	70	0	95·8	0	100	0	22	3·6
Sum ...	707·3	373	504·2	234	711·0	341	572·6	284	724·3	265	800	146	...	...
Mean ...	88·4	46·6	84	39	88·8	42·6	81·8	40·5	90·5	33·1	100	18·2	...	...

ROOT NODULES ON LUPINS.

An apparent difference in the type of bacteria needed for different varieties of Lupins grown at Muresk College.

A. B. ADAMS and J. H. RICHES.

In the September, 1929, issue of this Journal it was shown that at Merredin it was necessary to inoculate Lupins with their own strain of nodule producing organism if vigorous growth was desired.

The writers have noted that of three different varieties of Lupins growing on adjoining plots at the College, the Western Australian variety (*Lupinus pilosus*) has made vigorous growth and has set a satisfactory amount of seed whereas the imported varieties (*L. angustifolius* and *L. Merchels Liebucher*) have made spindly growth and set very little seed.

On examining the plants the roots of the first variety were found to be well supplied with root nodules and the roots of the other two varieties were not infected at all.

As the plots are adjoining, with only a foot path between them, and as none of them were inoculated, it is tentatively suggested that the Western Australian variety has adapted itself to the type of bacteria found in local soils but the imported varieties are dependent on a special race of the root organism.

THE COOLING OF MILK AND CREAM.

C. K. Baron-Hay,
Superintendent of Dairying.

Six years ago (Journal of Agriculture, June 1924), the writer drew the attention of dairy farmers to the large percentage of second grade cream then being received at factories during the summer months of the year, the peak being reached in February and March, when as much as 12 per cent. of all the cream received was second grade.

It is pleasing to be able to write that the position is much better to-day, but the opinion is held that this improvement is due to the great increase in production in the cooler portions of the State, and the less production in such areas as along the Great Southern, rather than to any great improvement in the method of handling.

Three factors operating to-day call for a timely warning to dairy farmers of the serious losses that may occur through the production of second grade cream :—

1. Keen competition of margarine (containing vegetable fats) with all but choice grades of butter. This has caused a serious difficulty in the disposal of second grade butter, except at extremely low prices.
2. The falling price of butter fat means a greater percentage loss to the dairy farmer through second grade cream, than when the price is relatively high

   Assuming second grade cream is worth 5d. per lb. less than first grade, with a similar fat content, then the loss to the farmer when butter fat is 1s. 6d. per lb. is 27·7 per cent. ; when, however, butter fat has fallen to 1s. 1½d. per lb., the loss to the farmer is 37 per cent.
3. Owing to present economic conditions, many farmers in comparatively dry, warm districts, are now endeavouring to produce cream for delivery to a factory.

The general farm practice necessary to produce first grade cream is detailed in Bulletin No. 180, "Care of Milk and Cream," issued free by the Department.

It is intended here, however, to deal with one important factor in this direction, namely, *cooling*.

The importance of reducing the temperature of cream *as quickly as possible* during the summer months cannot be over-estimated, and although a great reduction is difficult without artificial means, the reduction of the temperature by only a few degrees is most beneficial.

Cream separated on a warm day commonly records a temperature of over 90° Fah., and, unless some means are taken to lower this temperature rapidly, may remain so for some considerable time. At this temperature bacterial action is most rapid, and unfortunately the temperature is such as to stimulate the undesirable putrefactive and gas producing (fermenty creams) bacteria, at the expense of the desirable lactic acid producing bacteria, which thrive at approximately 60–70° Fah.

Cooling may be carried out in a variety of ways, dependent on the natural facilities of each farm:—

1. By allowing cream to flow over a water-cooled surface. *See* Fig. I.

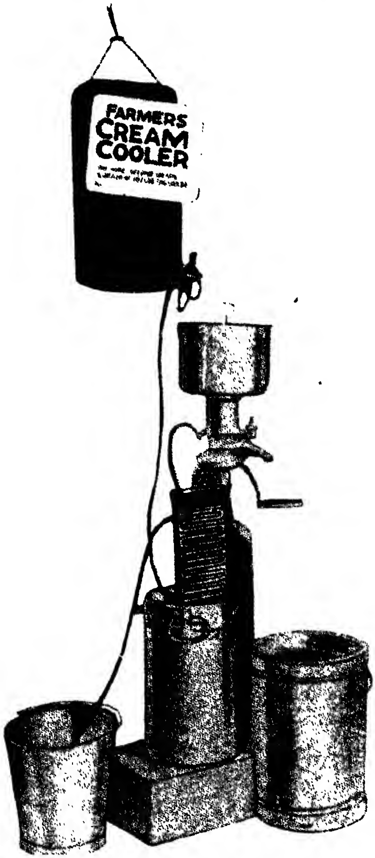


Fig. I.

The temperature to which the milk or cream can be reduced will depend upon the temperature of the water available, the quantity passing through the cooler, and the speed of the cream passing over the cooler.

The longer the cream can be kept in contact with the cooler, the more closely will its temperature compare with the cooling water.

The cream as it leaves the cooler should nor be more than 2° Fah. warmer than the water entering the cooler.

After separation, cream of course should be kept in as cool a place as possible. Covering the can with a white cloth, kept damp, is a good practice. Cream may *rapidly* be cooled 30°–40° Fah. by this method.

2. By standing cream can in a tank containing cold water, preferably running.

Water conducts heat approximately 21 times as fast as air. This means that, by surrounding the cream can with water, the cream will be cooled 21 times faster than by standing in air at the same temperature.

The tank used for cooling the cream should be deep enough to allow the water to cover the cans up to the top of the cream.

When separating, two cans should always be available, as *warm cream should never be run into the cold cream* from previous separation.

Where running water is available, the cooling tank may be placed between the source of supply and a trough, to obviate the waste of water. *See* Fig. II.

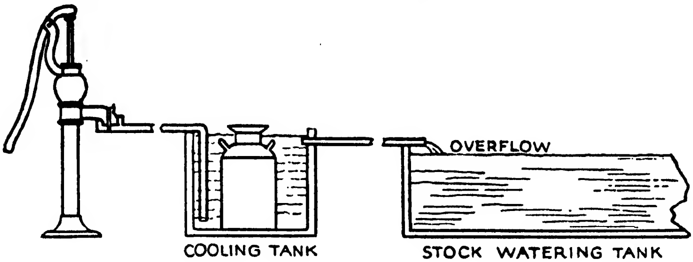
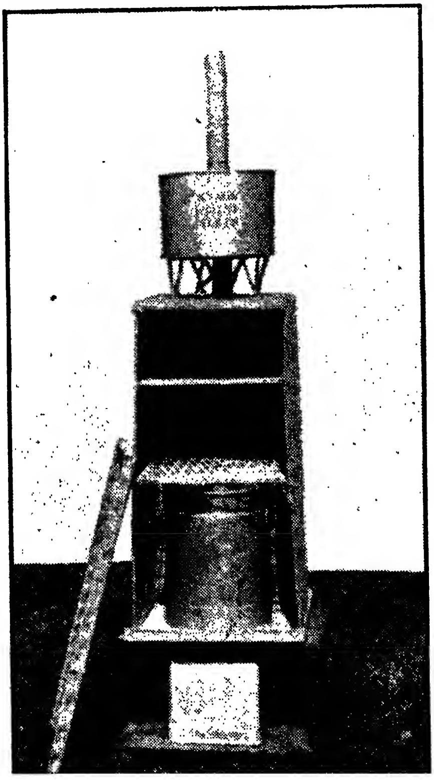


Fig. II.

3. By the use of a cooler of the Coolgardie Type. *See* Fig. III.



This particular type of cooler is most valuable in maintaining a low temperature, but does not reduce the temperature as rapidly after separation as do the other methods.

The Coolgardie Cooler, however, is of great value in keeping temperatures down in those areas where the water supply is precarious.

Points in connection with these coolers are:—

(i.) The framework should be of metal, as wood absorbs water, becomes infected with bacteria in time, and often grows moulds.

(ii.) Cooling depends on the evaporation of water, and to be effective the cooling surface, usually hessian, must be continually moist.

(iii.) Some device for permitting a constant flow of water, other than flannel strips, is desirable.

(iv.) Care must be exercised to see that the hessian is changed once a season as it is liable to become mould-carrying during the winter months when out of use.

(v.) Ventilation allowing a constant stream of fresh air is essential, otherwise cream will develop musty flavour mentioned below.

The practice of some farms of placing the warm cream in a closed cellar to there cool is to be deprecated, as cooling is necessarily slower than in an atmosphere where the air is flowing. Moreover, a peculiar smothered or musty flavour commonly occurs, which may be imparted to the butter.

In closing, it is well to remember that butter factories to which cream is delivered are operating under strict supervision, as regards their methods of manufacture, and it is only reasonable for the producer to take every step at his end to supply a choice cream for the manufacture of a choice butter.

THE BANANA IN WESTERN AUSTRALIA.

F. J. S. WISE,
Tropical Adviser.

THE BANANA AS A FOOD.

In his excellent official work, "What America can teach us," Mr. W. Ranger, of the Committee of Direction of Fruit Marketing, says in reference to the food value of the banana:—

> "The banana is one of the most important carbohydrate foods, and is a good source of two of the other four food elements required by the body, that is, mineral salts and vitamins. The banana heads the list of fresh fruits and surpasses most of the vegetables in food value. Attention is drawn to the fact that the banana is used in the treatment of celiac disease (chronic intestinal indigestion), one of the most troublesome disturbances of nutrition in late infancy and early childhood. Where it has been possible to give any carbohydrates without danger, the *ripe* banana has not only been well tolerated, but has rapidly brought about a better state of health."

The banana is more nutritive than the potato. In addition to the digestibility and palatability of the fruit the banana has another important feature, and that is its freedom from contamination because of its unbroken skin, the fruit really being in a germ-proof package.

CONSUMPTION.

The American consumption is 25 pounds per head per year. The Australian consumption is under 10 pounds per head per year, and in the Eastern States, where the market is well supplied, this could probably be doubled, while in this State our people are mostly starving for bananas, and if we could but produce them we have our whole population to serve.

VALUE OF THE INDUSTRY.

The world trade in the banana is enormous. The United Fruit Co. of America ranks as one of the first ten industrial companies in the United States of America. Its assets are over £40,000,000, and include a fleet of 80 steamers. It owes its prosperity entirely to the banana. In England Elders & Fyffes dominate the banana trade. This firm has ripening rooms capable of ripening 16,000 to 17,000 bunches at a time. The exports of the principal banana producing countries for 1929 were as follow:—

Jamaica ..	..	18,250,000 bunches	(mostly "Gros Michel" variety).
Honduras	..	14,500,000 ,,	,, ,, ,,
Columbia	..	10,870,000 ,,	,, ,, ,,
Costa Rica	..	7,660,000 ,,	,, ,, ,,
Guatemala	..	6,000,000 ,,	,, ,, ,,
Mexico ..	..	4,150,000 ,,	,, ,, ,,
Canary Is.	..	7,500,000 ,,	(Cavendish variety).
Panama ..	..	4,000,000 ,,	(mixed varieties).
Cuba ..	..	3,000,000 ,,	,, ,,

The principal markets are the United States, Great Britain and Canada. The United States of America and Canada combined take 53,000,000 bunches per annum and Great Britain and the Continent import 25,000,000 bunches per annum.

In our own country its commercial production has been limited to two of the Eastern States—Queensland and New South Wales—where the industry is worth nearly two millions sterling. It is probable that no better bananas are produced in the world than in Queensland, where there are 5,000 growers engaged in the industry, and whose sales in Australasia amount to £1,250,000 per annum. Regular fruit trains, carrying from 3,000 to 6,000 cases weekly, travel from the Brisbane districts and North thereof conveying the fruit to Sydney, Melbourne, and Adelaide. With such a regular supply these cities have placed the banana high on the list of foods. Our capital is, however, very unfortunately situated with regard to necessary supplies from Queensland. Several attempts have been made to establish a trade connection for Queensland bananas, but with no great success. This is not surprising, as their transport from Queensland to Perth involves six handlings by train and at least two by boat. It has to be borne in mind that quick transport, and good ventilation, are very necessary to ensure that the fruit shall arrive at its destination in good condition, for it is neither possible to freeze or chill the mature or immature banana. On the other hand, however, if we can produce our own requirements in the North, as is believed possible, Perth is fortunately situated, for it is as far away from the Eastern States plantations as from Java, and there is a direct shipping service between the North-West ports and Fremantle.

IDEAL CONDITIONS.

Ideal conditions for the production of the banana would be a deep well-drained rich alluvial loam, or well-drained soil of volcanic origin rich in humus, in a well sheltered position, free from frost, near the coast, and with a well dis-

tributed rainfall of 50 inches upwards. The most successful banana producing countries in the world in point of acre yields include Honduras, Columbia, and Queensland, and the average rainfall in the banana districts in these lands is between 60 and 90 inches. On the West coast of Guatemala, which has large acreages, the annual average is over 150 inches. We are unfortunate in this State in not having ideal natural conditions in any part of our long Western coastline, but in spite of this we should not lose hope of establishing the industry on a sound basis. It is really a remarkable coincidence that one of the driest and most windy parts of our coast, viz., the Carnarvon district, should offer the best chance of commercial success, mainly on account of the deep friable fertile loam of the river frontages, the plentiful supply of water for irrigation at shallow depths in the river bed, and the proximity to the metropolis—48 hours direct steam.

An eight months planted area at Carnarvon.

Almost a parallel with us in the important banana producing countries is the Canary Islands, where bananas are grown under irrigation, largely on terraces on the hillsides, and most of these terraces have been built up. The production is high, averaging about 1,000 bunches per acre. The only variety grown there is the one the Department has advocated for Carnarvon, viz., the "Cavendish."

SOILS OF THE FAR NORTH.

The peaty soils found in or near all the pandanus spring areas of the North-West, and of which Beagle Bay and Udialla (Fitzroy) are typical examples, should grow the "Gros Michel" variety successfully in addition to the "Cavendish." It is unfortunate that several good areas are growing thickets of "Plantains" instead of heavy producing and more marketable sorts. In the station gardens also I would strongly recommend the discontinuance of plantains.

VARIETIES.

Among the varieties grown commercially in Australia the "Cavendish" easily takes precedence. It is the most dwarfish in growth and, therefore, less liable to damage by winds. Under very favourable conditions it will grow to 14 feet in height, usually about 9 to 12 feet, and each stalk or plant in the stool is capable of carrying 30 dozen fruit.

The "Sugar" banana was at one time largely grown in Southern Queensland, but is now seldom seen on account of its susceptibility to the Panama disease. The growth is tall and, therefore, very subject to wind injury.

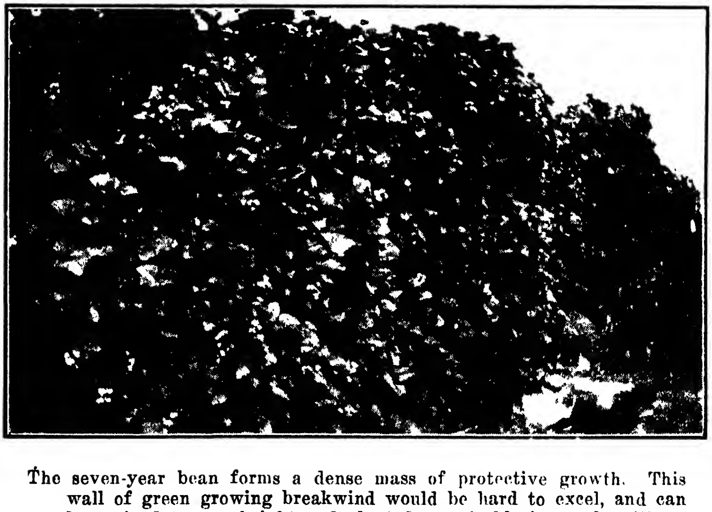
The "Lady's Finger" is also a tall grower, probably less susceptible to frost than the other varieties, but the fruit has not a great demand.

The "Gros Michel" is a tall grower, and is very partial to heat and heavy rains. The fruit is large and carries well, though it has not the flavour of the "Cavendish."

The many varieties which have from time to time been introduced from Java and Singapore to parts of the North-West are entirely unsuited for the conditions which obtain there; not only do they suffer from the severe winds, but it must be borne in mind that their success in their native lands is due to the excessive heat and copious rainfall the whole year through, which is accompanied by high humidity and not dry heat and drying winds, such as are typical of some portions of our North.

NECESSITY FOR BREAKWINDS.

Viewing Carnarvon as the most likely district for the successful commercial production of the fruit under irrigation, the necessity for effective breakwinds must be stressed. On the northern bank of the Gascoyne River there is some protection afforded by the river gums, and in some of the hollows right close to the



The seven-year bean forms a dense mass of protective growth. This wall of green growing breakwind would be hard to excel, and can be trained to any height and planted at suitable intervals without any detriment to the other growing crops.

river these may be sufficient. For the most part, however, it must be accepted that breakwinds must be provided to counteract the deadly effect of the winds. During the brief space in which endeavours have been made to grow the banana in Carnarvon several kinds of breakwinds have been tried, including high galvanised iron fences, but it is doubtful whether a cheaper or more effective breakwind could be obtained than systems of high trellises of seven-year beans, which quickly provide a dense growth to any required height. They can be made to reach any desired

height, and there is no doubt of their efficacy and *no doubt of their necessity* at regular intervals throughout the intended plantation. Without adequate protection for the leaves, which are the food-manufacturing laboratories of the plant, good results cannot be expected. The accompanying photographs clearly indicate the utility of the seven-year bean for this purpose.

The effectiveness of the seven-year bean as a breakwind is clearly shown in the large unbroken leaves.

PREPARATION OF THE LAND.

Although the plant is not for its size and bulk a deep rooter—the lowest roots seldom going deeper than three feet—deep and thorough preparation is every essential. In the East a plough is almost unknown in a banana plantation, as the fruit is mostly grown on the steep hillsides, some of which are so steep that the bunches are sent down to the lower levels and sheds on wires and pulleys. This land is naturally well drained, is often very stony, and in its virgin state is covered with dense jungle costing to £5 per acre for felling alone.

Under our conditions, however, we must by thorough and deep preparation assist to promote fertility, secure perfect drainage and render the land fit for the severe demands of the healthy banana plant.

GRADING AND DRAINAGE.

For the purpose of economical and even distribution of water, careful grading is necessary. When grading, the natural contour must be studied and utilised as far as possible.

LIMING.

After grading, the application of 1 to 1½ tons per acre of lime will be advisable where the soils are acid, broadcasted and lightly harrowed in. Lime is an essential constituent for the banana; it will correct soil acidity, in all probability retard nematodes, and is best applied some weeks before planting. On no account use artificial fertilisers for some weeks after the application of lime.

Should planting be delayed after the ground is ready for the suckers, or if time permits, a crop of cowpeas (a fertilised crop to secure a heavy growth) could be grown to advantage and ploughed in when the pods are just setting. This will afford the best opportunity to apply humus and will assist in the retention of moisture. All forms of organic matter are essential to vigorous banana growth, and every effort should be made to preserve and add to the existing humus content of the soil.

SPACING.

The land being graded, with the object of effective watering, should be laid out in suitable rows from 12 to 16 feet apart, the plants to be 10 to 12 feet apart in the row. For thorough cultivation and watering, this spacing should be regulated to suit local conditions. Crowding of suckers and plants will reduce the size of the fruit, and will most likely shorten the profitable life of the plant. On the other hand, experience with plants under irrigation has not been long enough to set down hard and fast rules. A trial of different spacings on a given area is suggested to the intending grower.

A very desirable type of sucker to plant is illustrated in this photograph. Note the taper of the leaves and of the sucker itself terminating at the base with a large butt.

SUCKERS.

Propagation is made by means of suckers. There are many kinds and types of suckers, and, as in the case of all plants, good propagation stock is an essential factor. Suckers with a large butt or corm, which usually appear above ground with pointed (commonly known as "sword") leaves are desirable. The small solid round sucker taken from the base of the parent forms a good plant. Split butts

also make excellent plants: in fact "bits," as they are called in America, are very popular as plants. If the butt is not split, it is a good idea to gouge out some of the eyes, leaving only those well spaced to grow. There is a distinct advantage with butts in that there will be two or more (according to the number of eyes left) first bunches of good quality at the first bearing. It is also found that the following suckers are more easily controlled. Broad-leafed water suckers, with slender stems, should at all times be avoided. Very forward suckers will yield a quick

A broad-leafed sucker, not a desirable type to plant. Usually with little vigour and throwing a small first bunch.

bunch, but best results will be obtained from well-developed tapering suckers (see illustration). Size is not so important as vigour, which is indicated in the length of the sucker, its taper and its large butt. To prepare the sucker for planting, trim off all roots as closely as possible, cutting the stem off well below the foliage. Try and use suckers in which the sword-leaf is not fully developed; next to them use "butts."

PLANTING.

Bananas under irrigation are being specially dealt with, and bearing this in mind it would be well to give the ground a good watering a week prior to planting. If the preparation has been thorough it will not then be necessary to water until the plants have started to grow. Local conditions also affect the depth to plant. In alluvial soils the plants may be put in deeper to advantage, but if the subsoil is heavy, on no account plant in deep holes. For Carnarvon conditions it is suggested that the plants be set out in holes dug out to 18 inches, the base of the sucker when planted not to be covered by more than 5 inches of soil, so that the plant is started slightly lower than the average level of the land. The filling-in of the hole is completed by cultivation and the gradual development of the plant.

TIME TO PLANT.

It may be found that early planting will be best at Carnarvon. Early planting, *i.e.*, as soon as possible after there is any sign of spring, has the advantage of the plant having a good hold and being in a robust condition before the slack-

ening off of the growing period at the approach of winter. Should there be any summer rains they will then materially assist the plants, especially if the weather is humid.

PERIOD OF MATURITY.

Should large butts or forward suckers be planted it may occur that two or three first plants with several following suckers will grow before the first bunch is produced. Provided there are not too many, it is seldom necessary to remove any suckers prior to bunching; the general practice is to leave all suckers until the maiden plant has produced its first bunch. Should three large suckers on one stool come into bearing with their first bunch simultaneously, careful note of the ages and position of following suckers must be taken. *Three suckers and no more* should be allowed to follow the first cutting, which will provide larger bunches

Bunch within a few weeks of maturity. Note the position of the supporting prop, high up to take the weight.

of better fruit than if more are allowed to grow. De-suckering should be effected as soon as possible after fruiting, and care should be exercised that not any more roots than necessary are cut and damaged. Use a specially made bent bar, or with care, an ordinary mattock will serve. Water suckers may be removed at any time by cutting the top off the offending sucker low down to the ground and gouging out the centre. This will kill the sucker and not disturb the plant.

Cultivation between rows will consist of keeping the ground clean and the surface loose. When chipping close to the plants do not chip too deeply, but at a distance from them a deeper chipping or cultivation is suggested, which will assist the plants to root more deeply, and, in consequence, withstand dry spells better, and may also be a means of combating the nematode.

PROPPING BUNCHES.

It is necessary to prop the first bunch to prevent the plant from falling over. The weight of the bunch with the first fruit set almost pulls the plant out of the ground, and it is advisable as soon as the bunch is "set" to relieve the plant of the strain. Light props of split or round timber should be used, sufficiently long to form a solid support to the plant by placing high up immediately under the bunch, with the other end firmly in the ground. See the illustration showing how the prop should be placed. This is an important item, and by pressing the prop into the soft plant at the base of the bunch "handle" the plant is made quite rigid, and there is no danger of the bunch falling over, whereas if the prop is placed low down the plant will break off half-way up.

REMOVAL OF THE FLOWER BALL.

This is a practice not universally adopted. If it is done it should not be broken off too early or the plant will bleed for days and the fruit will suffer much more than if the ball is left on. The bleeding may be stopped by placing some soil on the cut made.

CUTTING THE BUNCH.

When the fruit has become rounded and filled it is approaching maturity, it will have lost it angles and will split from end to end if touched with the point of a sharp knife. Cut the bunch with as long a handle as possible for convenient handling, and do not bump or bruise the fruit. Every bump or bruise at this stage will appear in the ripened fruit. The absolutely correct stage to cut the bunch can only be determined by experience and observation. In the cooler months the fruit will hang much longer, and in any season the longer it can be left on to permit reaching the market in the proper condition the better. For some time at any rate the fruit grown at Carnarvon or anywhere in the North-West will find a local market and will, therefore, be marketed in the bunch. Later on, when there is a sufficiency to send to the city markets, the fruit will be packed in 1½ bushel cases. Systems of packing, etc., will be dealt with when this time comes.

CUTTING OUT THE MATURED PLANT AFTER BEARING.

On some plantations in the Eastern States the plant which has completed its life's work and borne fruit is left for a few weeks before removal. The reason for this is that the sucker following is less likely to be damaged, and very quickly forges ahead if the parent stem is left for a few weeks. There is a danger in this practice, however, and that is there is a possibility of it being neglected, and in dying back forming a harbour for borers and other pests. On this account it is best, after removing the bunch, to cut out at once the finished plant as close to the ground as possible. It will then heal over and not form a harbour for borers. As above mentioned, be careful not to injure the "following" sucker during this operation. It can be taken that the first bunch will be cut any time from 14 to 20 months, according to the condition and age of the planted sucker, and the first following sucker of the parent will bear the next year.

LIFE OF THE PLANTS.

With care and proper treatment it is possible that the life of the plantation under our conditions should be at least six years. Under ordinary circumstances, *i.e.*, relying on natural conditions and rains, this would be a long life, and above

the average of profitable life of most banana-producing lands. The plants would probably live until killed by disease, but if kept well watered, tended and fed, should live for six years, but heavy fertilising will be necessary after the second and third bunch to maintain the fruit of size and quality.

MANURING.

Although bananas may be grown in soils deficient in essential plant foods, they will not thrive unless the required constituents are made available. It is advisable that the humus content or the supply of organic matter should be high, and that it be kept up by green manuring, or other means.

A complete fertiliser for the banana recommended by Brunnich, and extensively used in the Eastern States, may be made from the following:—

Dried Blood—2 cwt.
Superphosphate—2 cwt.
Sulphate of Potash—2 cwt.

or

Nitrate of Soda or Dried Blood—2 cwt.
Bonedust—2 to 3 cwt.
Sulphate of Potash—2 cwt.

Both of these mixtures can be applied at the rate of five to eight pounds per mature stool; higher or lower quantities according to age, etc., of plants. Apply the above mixtures in two dressings, one towards the end of summer and the other at the end of winter. A very light dressing of salt at the rate of 1cwt. of common salt per acre will benefit plants in soils of very low salt content, or to be safe and to assist to make good this deficiency use muriate of potash instead of sulphate of potash.

As can be expected with plants yielding such heavy crops, there is a constant drain on the fertility of the soil, and, generally speaking, it can be confidently stated that the banana cannot be overfed.

GREEN MANURING.

In the older countries of the world continuous cropping has gone on for centuries, and has been made possible by rotation of crops and a heavy supply of organic matter. Soils rich in iron, soils in hot climates, and soils cropped with such heavy feeders as tomatoes, bananas, etc., need heavy supplies of organic matter to retain their fertility. Soils of good humus content are able to retain moisture, and make good use of any chemical fertiliser applied. The growing of leguminous crops between the rows, especially if the land is fertilised for those crops, is a sure way to assist in this direction.

DISEASES AND PESTS.

Although the banana is prone to very many diseases of all kinds, including rusts, leaf spots, virus disease (bunchy top), Panama disease, etc., at present there are only two calling for lengthy comment at this stage of our development. They are banana weevil borer and nematodes.

BANANA WEEVIL BORER (*Cosmopolites sordida*).

This pest was found to be in the plantains in the Carnarvon district in 1923, when the first effort was being made to produce the banana commercially in this State. This pest is scattered throughout Australia; it has cost the banana in-

dustry of the world immense sums, and was introduced from the Pacific Islands and from the West Indies, very many years ago, prior to the passing of the Federal Quarantine Acts.

The beetle or fully matured insect is a true weevil about half an inch in length, with a very prominent trunk or proboscis; it has a hard shell, and like all weevils, feigns death when disturbed. The beetle usually lays its eggs at the base of the stem or on the corm, and when they hatch out the larvae eat their way into the corm, which they eventually tunnel through and destroy. The larvae are yellowish grubs about half an inch long with a brownish-coloured head. The general symptoms of the presence of the pest are a general unthrifty appearance of the plant, the whole plant showing signs of deterioration, bunches are small, and in the very advanced stages the plants have such a poor hold of the ground that they fall or are easily pushed over. The insects are usually of a very sluggish nature, do not travel far from their feed, and are usually spread by means of infested suckers and plants. Flight also plays some part in the dispersal of the pest, but, unless the plantations are contiguous, there is little danger from this means of infestation.

We know that this pest is in the Carnarvon district, and, therefore, even if there are no symptoms of it in any plantation, a careful lookout is urged, and, if the beetles are found, no time or effort should be spared in an endeavour to exterminate them.

CONTROL MEASURES.

As has been repeatedly pointed out by our Entomologist, there is little hope of employing sprays or fumigants against this pest, as in all stages of its life cycle, except the adult stage, it is securely protected behind a barrier of plant tissue; attention must, therefore, be confined to the beetle itself.

In practice it has been found that the beetles are attracted to baits, and further, that the beetles so attracted may be killed by poison. A simple method of trapping the mature insect has been practised for years. It has been found that the beetle is very partial to the flesh or the fully matured corm, and by taking the corm from the base of a stem having matured its bunch, cutting it in halves and placing the cut surfaces to the ground near the stool, the insects will be attracted and will be found adhering to the bait or immediately under it, and can be gathered and destroyed. By dusting the baits with Paris Green the two operations may be combined. It is desired to impress and insist that it is a serious obligation on the part of all interested in the industry to keep a careful watch for this pest, and the policy to be adopted is to keep new areas clean by careful examination and trimming of suckers prior to planting, and, should infestation occur, destroy all corms showing the presence of borer tunnels and adopt the simple measures of control herein mentioned.

NEMATODE OR EEL-WORM.

This is a serious pest in some areas in the State and is very destructive. The list of economic plants attacked is very large, and the presence of the pest in the root system is usually associated with disastrous results to the plants attacked. Although a large number of species of gall worms are included under the name of nematodes, the most serious is the one which affects bananas, tomatoes, potatoes, beet, pineapples, watermelons, etc. The disease is readily seen on examination of the roots, when irregular lumps will be seen which interfere with the functioning of the plant. The banana is very susceptible. When the young nematode enters the root it begins to enlarge, and feeds on the root tissues, irritating them;

they then swell and form the gall, and so serious does the trouble become that water and the plant foods cannot pass through the roots. It can be definitely stated that the cure of infested plants is quite outside the bounds of possibility, hence control should aim at destroying or reducing the number in infested soils, and keeping uninfested land clean. The spread of the pest is facilitated by ordinary farm operations; implements used in infested areas will transfer the pest, and they will be similarly transported in the soil adhering to the boots of men or to the hoofs of horses. They will also be carried in the water when irrigating.

Prior to planting bananas in new land, after all the roots have been closely trimmed, the plants should be immersed in a solution of corrosive sublimate at a strength of 1oz. to six gallons of water, and, as dealt with earlier, the plants should be set in a depression in the soil. Even where infestation is present, plants may be kept on a profitable basis by constant and thorough cultivation and heavy manuring. The most economic way to control the pest is by a system of rotation in which crops which are immune to the attack of nematodes feature prominently. In this way they may be starved out of the soil. Nematodes have been known to live in soil for more than a year, even when no food plants are present, so that a systematic rotation is very necessary. Among the plants that are immune to attack, or are but slightly affected, are maize, sorghums, broom millet, barley, peanuts, some cowpeas, most grasses, and velvet beans. These common crops, which are known to be resistant to the attack of the pest, may be used in a well planned rotation with profit, and should permit of the subsequent growing of the banana in a soil in which the pests have been reduced to a minimum.

OTHER DISEASES.

There are many diseases of the fruit and leaves as well as many pests, some of which are of trifling importance to the grower. There are, however, some chances that the industry will be handicapped by the incidence of pests, such as fruit-eating caterpillars and fruit spotting bugs, which will, when they appear, be dealt with by the Entomologist of the Department of Agriculture.

"LUMPY OR MATTED WOOL," OR MYCOTIC DERMATITIS IN SHEEP.

J. F. Filmer, B.V.Sc.

During recent years several cases of a peculiar condition affecting the skin and wool of sheep have been brought to the notice of the Veterinary Branch.

In these cases the wool has been found to be matted together by a hard horny-like material. As a rule this does not come to the tip of the wool and the disease may therefore not be detected until the animal is handled. It will then be found that the horny-like material is really an exudate coming from a disease of the skin. The horny masses are generally somewhat cone shaped, with the broad base towards the skin. Thus when an affected mass of wool is removed all the wool will be matted together at the base, whereas at the tip there will be a proportion of normal wool outside the horny matted core.

In active cases these horny masses are rather firmly attached to the skin and can only be detached with difficulty. When this is done the exposed skin presents an inflamed appearance. The base of the horny cone will be found to be concave. It is attached to the skin around the outer edge only.

In cases which have ceased to be active the affected masses of wool may have been pushed away from the skin and there may be normal wool underneath them. Generally the back only is affected, but occasionally the head and legs may become involved.

Until recently the cause of this condition was not known. However, during 1929, reports were published by Dr. H. R. Seddon, New South Wales, and Dr. L. B. Bull, in South Australia, concerning investigations of this disease. Both these Veterinary Pathologists discovered in the scabs of affected sheep a fungus or mould. Dr. Bull has grown this in artificial media and has produced the disease with pure cultures of the organism for which he has proposed the name Actinomyces dermatonomus. Working with material from a Western Australian case an organism was recently discovered which appears to be identical with that described by Dr. Seddon and Dr. Bull.

In New South Wales and South Australia the disease has been found to be largely confined to young sheep, under two years old. As a rule only a small percentage of the flock is affected, though cases of 10 and 20 per cent. affection of small flocks of young sheep have been reported in South Australia.

The disease may be transmitted by rubbing into the skin an emulsion of scab from an affected sheep. So far it has not been found possible to affect a healthy sheep by confining it with affected sheep. There is some evidence to show that the disease is contracted during wet weather and that moisture of the fleece makes a sheep more susceptible.

In Western Australia, in one flock where several cases of this disease have occurred, another condition was detected. In these sheep small granules of yolk-like material were seen in the wool and the sheep were noticed to have been rubbing. Examination in the laboratory did not enable any definite conclusion to be reached, but it is suggested that this may be the early stage of the same disease.

Very little work has yet been done in regard to prevention and cure. However, Dr. Bull has shown that the organism is readily destroyed by Copper Sulphate solution, and has suggested dipping in a solution containing 1 lb. Copper Sulphate in 50 gallons of water.

All affected sheep should be shorn as soon as detected and should then be dipped in the above solution. If the disease threatens to become widespread, young sheep should be dipped in the Autumn immediately after first rains. If the disease appears they should be re-dipped a month later.

Dr. Seddon has shown that the detached scab may remain infective for over a year. It is therefore important to prevent affected sheep shedding scabs in the paddocks. Affected sheep should be segregated and shorn separately and all affected wool should be burnt.

TRIALS WITH THE CASSINA TEA PLANT.

(*Ilex vomitoria.*)

By G. L. THROSSELL, Agricultural Adviser.

In order to ascertain whether the Cassina Tea Plant (*Ilex vomitoria*), a tea substitute, could be grown successfully in Western Australia, samples of the seed received from the "Sunday Times" Newspaper Company, Limited in 1927, were planted at the Merredin and Chapman Experiment Farms for trial.

The Cassina Tea plant is a native of the South Atlantic and Gulf coasts of the United States, where it was used by the American Indians for making a stimulating beverage. Another species, *Ilex Paraguayensis*, commonly called Yerba Mate, is used extensively in South America, and in the Argentine alone more than 140,000,000 lbs. per annum are consumed, the source of this being chiefly Brazil and Paraguay.

The seed supplied to this department was sent to the Chapman Experiment Farm for "stratification," a process of placing the seed in layers of moist sand for a period of six months prior to planting. Portion of this stratified seed was then sent to the Merredin Experiment Farm, and plantings were made that year (1928) at both farms in well worked fallow. The soil at the Chapman Farm was a sandy loam, and at the Merredin Farm a sandy and clay loam, and both were ploughed early in the previous winter and cultivated as required to maintain a mulch and destroy weed growth until planting time. At both farms none of the seed germinated, despite the care that had been taken.

The rainfall recorded during 1928 was 8.73 inches at the Merredin Experiment Farm and 17.89 inches at Chapman, while the average rainfall at these farms is respectively 11.85 inches and 16.45 inches.

The result of this trial confirms the view held by the late Government Botanist and Plant Pathologist (Mr. W. M. Carne) who, in December, 1927, reported on the Cassina Tea Plant as follows:—

"There appears to be little hope of this plant succeeding in this State, either horticulturally or commercially.

1. The plant is native to coastal, sandy soils in the States of Virginia, Texas, North and South Carolina, and to other South-Eastern portions of the United States of America. These areas have rainfalls varying from 45 to 60 inches per annum, of which approximately two-thirds occurs in the summer, with not less than two inches in any month. We have no corresponding climatic area on the coasts of this State.

2. From our experience with Yerba Mate, which was distributed in 1926, there is little doubt that Australians will continue to use tea in preference to any substitutes. Ilex preparations resemble tea only in the modes of preparation. It is unlikely that they would ever have a big sale in Australia though they may have a limited sale amongst food faddists and people unable to take tea."

AGRICULTURAL SEEDS AND THEIR WEED SEED IMPURITIES.

H. G. ELLIOTT, Dip. Agric.
Assistant Plant Pathologist.

(*Continued from p. 494.*)

Scientific Name.	Common Name.
vi. Dactylis glomerata	Cocksfoot
Containing :—	
A. *Grasses*—	
Lolium perenne	Perennial Rye-grass
B. *Other Weeds*—	
Rumex acetosella	Sorrel (3)
vii. Bromus unioloides	Prairie Grass
Containing :—	
A. *Legumes*—	
Trifolium dubium	Suckling Clover
B. *Grasses*—	
Avena fatua	Black Oat
A. sativa	Oat
Paspalum dilitatum	Paspalum
C. *Other Weeds*—	
Malva parviflora	Mallow
viii. Chloris gayana	Rhodes Grass
Containing :—	
A. *Grasses*—	
Agrostis vulgaris	Red Top (2)
Setaria viridis	Pigeon Grass (3)
B. *Other Weeds*—	
Amaranthus retroflexus	Pigweed
Plantago lanceolata	Ribgrass (2)
ix. Lolium perenne	Perennial Rye-grass
Containing :—	
A. *Legumes*—	
Medicago denticulata	Burr Medic
M. lupulina	English Trefoil (2)
Trifolium agrarium	Hop Clover
T. dubium	Suckling Clover
T. repens	White Clover (4)
B. *Grasses*—	
Bromus hordeaceus	Silver Grass (3)
B. mollis	Soft Brome (2)
* B. secalinus	Chess or Cheat
Festuca bromoides	Silvery Grass (3)
F. Myuros	Silvery Grass (2)
Holcus lanatus	Yorkshire Fog (2)
Lolium multiflorum	Italian Rye-grass (5)
Phleum pratense	Timothy
C. *Other Weeds*—	
Brassica nigra	Black Mustard (3)
Hypochœris radicata	Flat Weed
Myosotis sp.	Forget-me-not
*Polygonum persicaria	Smartweed
Ranunculus sp.	Buttercup (2)
Rumex acetosella	Sorrel
Rumex spp.	Docks (4)

Scientific Name.	Common Name.
x. Lolium multiflorum	Italian Rye-grass
Containing :—	
A. *Legumes*—	
Medicago denticulata	Burr Medic
Trifolium dubium	Suckling Clover (3)
T. pratense	Red Clover
B. *Grasses*—	
Alopecurus sp.	Foxtail
*Bromus secalinus	Cheat
Festuca bromoides	Rat-tail Grass (3)
Holcus lanatus	Yorkshire Fog
Lolium perenne	Perennial Rye-grass (2)
C. *Other Weeds*—	
Brassica nigra	Black Mustard
*Centaurea cyaneus	Star Thistle
Daucus carota	Carrot
Hypochoeris radicata	Flatweed
Plantago lanceolata	Ribgrass
*Polygonum persicaria	Smartweed
Ranunculus sp.	Buttercup (2)
Rumex acetosella	Sorrel
Rumex spp.	Docks
Sonchus oleracea	Milk Thistle (2)
xi. Lolium subulatum	Wimmera Rye-grass
Containing :—	
A. *Legumes*—	
Melilotus indica	King Island Melilot
Medicago denticulata	Burr Medic
Trifolium agrarium	Hop Clover
G. *Grasses*—	
Avena sativa	Oat
Bromus hordeaceus	Silver Grass
B. madritensis	Spear Grass
B. mollis	Soft Brome (2)
Festuca bromoides	Silvery Grass (3)
F. Myuros	Silvery Grass (2)
Hordeum murinum	Barley Grass (2)
Lolium multiflorum	Italian Rye-grass (3)
L. perenne	Perennial Rye-grass (2)
Phalaris minor	Canary Grass
C. *Other Weeds*—	
*Polygonum aviculare	Wireweed (2)
Rumex acetosella	Sorrel
Silene gallica	French Catchfly
xii. Triticum sativum	Wheat
Containing :—	
A. *Legumes*—	
Vicia spp.	Vetches (2)
B. *Grasses*—	
Avena sativa	Oat (8)
Hordeum vulgare	Barley (4)
Lolium perenne	Perennial Rye-grass (3)
L. temulentum	Drake (4)

Scientific Name.	Common Name.
C. *Other Weeds*—	
Amaranthus retroflexus	Pigweed
*Brassica sinapistrum	Charlock (2)
B. nigra	Black Mustard (2)
*Galium aparine	Cleavers (5)
*Lychnis Githago	Corncockle
*Polygonum convolvulus	Black Bindweed (3)
*P. persicaria	Persicaria
Ranunculus arvensis	Buttercup
*Raphanus raphanistrum	Wild Radish (3)
Rumex spp.	Docks (2)
Scandix Pecten-Veneris	Shepherd's Needle
xiii. **Hordeum vulgare**	Barley
Containing :—	
A. *Grasses*—	
Avena sativa	Oat (4)
A. sterilis	False Wild Oat (2)
Bromus villosus	Brome Grass
B. *Other Weeds*—	
*Raphanus raphanistrum	Wild Radish (4)
Silene gallica	French Catchfly (2)
2. MORACEAE.	
i. **Cannabis sativa**	Hemp
Containing :—	
A. *Legumes*—	
Pisum arvense	Field Pea
B. *Grasses*—	
Andropogon sorghum	Sorghum
Panicum miliaceum	French Millet
Setaria italica	Italian Millet
C. *Other Weeds*—	
Coriandrum sativum	Coriander
3. POLYGONACEAE.	
i. **Fagopyrum esculentum**	Buckwheat
Containing :—	
A. *Grasses*—	
Lolum perenne	Perennial Rye-grass
Linum usitatissimum	Linseed (Flax) (3)
Panicum miliaceum	French Millet
4. CHENOPODIACEAE.	
i. **Beta vulgaris**	Beet and Mangel
Containing :—	
A. *Grasses*—	
Avena sativa	Oat
Hordeum vulgare	Barley
Lolium temulentum	Drake
Phalaris canariensis	Canary Grass
Triticum sativum	Wheat
B. *Other Weeds*—	
Brassica nigra	Black Mustard
Euphorbia peplus	Milkweed
*Galium aparine	Cleavers (5)
*Polygonum convolvulus	Black Bindweed
Rumex spp.	Docks

Scientific Name.	Common Name.
5. CRUCIFERAE.	
i. Brassica spp.	Cabbage, Turnip, etc.
Containing :—	
A. *Legumes*—	
Melilotus indica	King Island Melilot (3)
Trifolium incarnatum	Crimson Clover (2)
T. glomeratum	Cluster Clover
T. pratense	Red Clover
B. *Grasses*—	
Oryza sativa	Rice
Triticum sativum	Wheat
C. *Other Weeds*—	
Brassica nigra	Black Mustard (3)
Cichorium intybus	Chicory (2)
Chenopodium album	Mexican Spinach (3)
*Echium sp.	Viper's Bugloss
Fumaria officinalis	Fumitory (2)
*Galium aparine	Cleavers
Plantago lanceolata	Ribgrass
*Raphanus raphanistrum	Wild Radish
Rumex spp.	Dock (3)
Silene noctiflora	Catchfly (2)
ii. Raphanus sativa	Radish
Containing :—	
A. *Grasses*—	
Triticum sativum	Wheat
B. *Other Weeds*—	
Chenopodium album	Mexican Spinach (3)
*Galium aparine	Cleavers
*Polygonum aviculare	Wireweed
6. ROSACEAE.	
i. Poterium sanguisorba	Sheep's Burnet
Containing :—	
A. *Legumes*—	
Hedysarum coronarium	Hedysarum (2)
Lathyrus spp.	Vetchlings (2)
Onobrychis sativa	Sainfoin (4)
B. *Grasses*—	
Avena sativa	Oat (2)
Hordeum vulgare	Barley (2)
Lolium perenne	Perennial Rye-grass (2)
Phalaris canariensis	Canary Grass
Triticum sativum	Wheat (3)
C. *Other Weeds*—	
*Echium spp.	Viper's Bugloss (2)
Euphorbia spp.	Milkweed (2)
*Galium aparine	Cleavers (2)
Linum usitatissimum	Linseed (Flax) (3)
*Polygonum convolvulus	Bindweed (2)
*Raphanus raphanistrum	Wild Radish (4)
Tragopogon sp.	Salsify (2)

* Noxious weeds under the Agricultural Seed Act, 1923.

(To be continued.)

NITROGENOUS FERTILISERS.

L. J. H. TEAKLE,
Plant Nutrition Officer.

Sir William Crookes, F.R.S., in his Presidential address to the British Association for the Advancement of Science in 1898, discussed the world's wheat supply and the possibility of a shortage of this superior food of the Caucasian race. From a study of statistics and an estimation of the virgin land available for cultivation in the new countries, Australasia, America, etc., he predicted that there would be a shortage of wheat from 1931 if the wheat eating population of the world maintained the normal rate of increase and the bushel yield per acre remained stationary. Sir William Crookes suggested that the supply of available nitrogen was the limiting factor in production, and submitted the problem of commercial fixation of atmospheric nitrogen to chemists. The year 1931 dawns upon a market glutted with wheat, and we find that the chemist has been able to provide the agriculturalist with an abundance of cheap synthetic nitrogenous fertilisers to supplement the enhanced supplies obtained as bye products from the coal industries, and those supplies arising from biological action in the soils themselves. The mechanisation of agricultural practice has greatly increased the efficiency of farm labour, and with improvements resulting from biological research has enabled the confines of the wheat belt to be widened to an undreamed of extent. A food shortage in the near future is unlikely, as the still untapped resources of North and South America and Australia are available when the call for more wheat is raised. The production from these countries merely supplements that of the closely settled nations where intensive methods, calling for the continued use of the new nitrogenous fertilisers, are responsible for a lessened demand for the primary products from overseas. It now becomes a battle for the diminished markets, and the line of attack appears to be by way of lowered production costs. It is imperative that the cost of production per unit be reduced if products are to compete successfully in the world's markets.

Among the avenues leading to a reduction of production costs is that of an improved fertiliser practice, and farmers are now being urged by manufacturers to make use of nitrogenous fertilisers to enhance the return for their effort.

In view of the increasing attention being given to the use of inorganic nitrogen compounds as fertilisers, it will be of interest to follow the history of some of the more important types.

Sodium nitrate, or Chili saltpetre, was first exploited in 1830, when a shipment of 800 tons was obtained from Iquique, South America. By 1840 the annual output had arisen to 10,000 tons, and in 1907 amounted to 1,660,000 tons of the crude salt containing 15 to 16 per cent. nitrogen (H. J. Wheeler, "Manures and Fertilisers"). In 1928 the consumption of Chili saltpetre amounted to 2,550,000 tons per annum.

Ammonium sulphate was first manufactured successfully along commercial lines in 1858, when it was obtained as a bye-product of the coke industry at St. Denis. By 1903 over 450,000 tons of ammonium sulphate per annum were produced in the coal industries, and this figure increased to 1,920,000 tons in 1928.

Synthetic nitrogenous fertilisers were first available on the market in the first decade of this century.

In 1905 Birkeland and Eyde in Norway succeeded in commercialising the production of nitric acid from the nitrogen and oxygen of the air and marketed the produce as nitrate of lime or Norwegian saltpetre.

Frank and Caro in Berlin prepared calcium cyanamide, "nitrolime" or lime nitrogen, in 1895, but very little was produced for several years. By 1912, however, factories had been established in various parts of the world, and sales in that year amounted to about 100,000 tons per annum. The commercial product contains 17 to 20 per cent. nitrogen.

The Haber process for the combination of gaseous nitrogen and hydrogen to form ammonium salts was commercialised during the war in Germany. After the war the German and English interests combined, and in those countries enormous quantities of ammonium sulphate are now being produced by this method. In 1924 1,250,000 tons of ammonium sulphate were produced by the modified Haber process, and in 1928 the production amounted to over three million tons per annum.

Table 1 shows the world's output of nitrogenous manures in long tons of pure fixed nitrogen.

TABLE 1.

The World's output of Nitrogenous Fertilisers, 1903–1928, expressed as long tons of Pure Nitrogen.

Fertiliser Produced.	1903.		1912.		1924–25.		1927–28.	
	tons.	%	tons.	%	tons.	%	tons.	%
Sulphate of ammonia, by-product ...	108,000	32·8	247,000	36·5	290,000	26·0	384,300	23·6
Sulphate of ammonia, synthetic ...	...	...	...	...	255,000	23·1	607,000	37·3
Calcium nitrate, synthetic	...	...	10,000	1·5	25,000	2·3	29,400	1·8
Cyanamide (lime nitrogen), synthetic ...	...	...	19,000	2·8	115,000	10·4	223,000	13·7
Chili saltpetre (mined)	221,000	67·2	401,000	59·2	363,000	32·8	383,000	23·6
Others	...	...	...	...	60,000	5·4	...	...
Total ...	329,000	...	677,000	...	1,108,000	...	1,628,700	...
Value at £75 per ton	£24,675,000		£50,775,000		£83,100,000		£122,152,000	

From this table it is seen that ammonium sulphate constituted 60.9 per cent., the nitrate fertiliser 25.4 per cent., and the lime nitrogen 13.7 per cent. of the total output in the year ending May, 1928. Of this total output of 1,628,700 tons of pure fixed nitrogen, 1,425,000 tons were used in agriculture.

While the world's output of nitrogenous manures has reached such enormous dimensions, Western Australia, as yet, depends very largely on her natural resources; we rely on the biological activities in our soils to maintain the supplies of available nitrogen. There is an increasing interest being evidenced in these valuable amendments, and the number of lines now on the market shows that the advantages of the use of nitrogen for crop growth is being emphasised by merchants and recognised by farmers. While the quantities used are still small, there is every likelihood of a material increase in consumption in the future.

The imports into Western Australia for the year ending 30th June, 1930, are shown in Table 2.

Table 2.

Nitrogenous fertiliser imported into Western Australia, 1st July, 1929, to 30th June, 1930.

Fertiliser.	Imports. Tons.	Per cent.
Ammonium sulphate	2,369	53.4
Sodium nitrate	1,735	39.1
Nitrophoska	272	6.1
Calnitro	30	0.7
Diammonphos	31	0.7
Ammonium chloride	1	..
Total	4,438	100

NITROGENOUS FERTILISERS IN AGRICULTURE.

It is recognised that nitrogen is the plant food most urgently required in many parts of the humid region of the world. This is the general experience in England, where response to other fertilisers is often conditioned by an adequate supply of nitrogen as fertiliser. It is reported in "Farm Notes," Vol. 4, p. 4, 1930, that Sir John Russell has calculated that for all soils and climates in the British Isles, 1cwt. of ammonium sulphate will give an average increase of 2½cwt. (4 bushels 40 lbs.) of wheat. Similar calculations have been made to show that the yield of barley would be increased from 4 to 7 bushels, winter oats from 7-12 bushels, potatoes 15-20cwts., and sugar beet 20-25cwts. per acre.

As soils become exhausted by continual cropping it becomes important to enhance the supply of available nitrogen either by crop rotation and management or the addition of artificials.

Even in Western Australia it appears that the nitrogen supply in certain of our light lands must be improved before full advantage can be taken of phosphatic manures, and it seems likely that there will be an increased demand for these fertilisers as new systems of agriculture and stock management are adopted, as has been the experience in Germany and England.

Returns from nitrogenous dressings in Western Australia show that there is a decided nitrogen lack under certain conditions. Yields of potatoes were doubled at Gosnells by the addition of 500lbs. of sulphate of ammonia per acre (Palmer, J. C., 1929). At Benger slight increases in the yield of potatoes were obtained by the use of ammonium sulphate (Palmer, J. C., 1930). Wheat responded to ammonium sulphate on the Wongan Hills Light Lands Experiment, the average yields of grain of the five plots devoted to each experiment being as follows:,

	Fallow.	Non Fallow.
No nitrogen	377 lbs./ac.	578 lbs./ac.
1 cwt. ammonium sulphate per acre ..	668 lbs./ac.	748 lbs./ac.
2 cwt. ammonium sulphate per acre ..	731 lbs./ac.	877 lbs./ac.

All plots received the usual dressing of 120lbs. of 22 per cent. superphosphate per acre (Thomas & Venton, 1930).

Very marked stimulation of the growth of Wimmera rye grass following the application of ammonium sulphate at the rate of 1cwt. per acre has been observed on the coastal plain at Esperance and on Mr. W. G. Burgess's farm at "Tipperary," York.

Experiments on Mr. Pearson's farm at Benger, near Bunbury, this year show that the carrying capacity of pasture is improved by nitrogenous dressings in addition to superphosphate. Four acre paddocks were grazed to cows with the following results:—

No nitrogen—467 cow grazing days.

150lbs. nitro chalk (per acre) applied in autumn—522 cow grazing days.

Ammonium sulphate, (per acre) 1cwt. in autumn and 1cwt. in spring—590 cow grazing days. ("West Australian," 13th Nov., 1930.)

These experiments indicate that there is a field for the judicious use of nitrogenous fertilisers in Western Australia or, failing that, a necessity for the rotation of crops to maintain or increase supplies of available nitrogen in the soil by biological means.

NITROGENOUS FERTILISERS AND THE SOIL.

It has been found by experiment and experience that the use of nitrogenous fertilisers has a great effect, not only on crop growth, but on the soil. Some forms, for instance, sodium nitrate, are physiologically alkaline, that is, they lead to the improvement of acid soils as a result of crop growth and the utilisation

of the nitrate. Others, for instance ammonium sulphate, are acid forming materials, or physiologically acid fertilisers, and induce serious soil acidity in the absence of adequate supplies of lime. For this reason it is necessary to be very careful in the selection and use of nitrogenous fertilisers. Sodium nitrate is

found to be deleterious for certain crops on the basic soils of arid or semi-acid regions. The writer has seen orange trees practically ruined by this fertiliser at riverside, California. Heavy clay soils, even under humid conditions, are found to be slightly puddled by sodium nitrate due to the effect of the element sodium which reacts with the soil.

Calcium nitrate or Norwegian saltpetre is a physiologically alkaline substance but is expected to improve the soil structure on account of the lime present.

Ammonium salts must always be used with caution if the soils are light textured and low in lime. A programme of liming is indispensible where ammonium fertilisers are used on these soils except for certain acid tolerant crops. Deherain recommends ammonium salts for use on stiff or heavy land only.

The choice of nitrogenous fertilisers may determine the composition of a pasture. At Rhode Island, U.S.A., the ammonium sulphate plots were dominated by red fescue and sheep's fescue, while on the sodium nitrate plots adjacent these plants were practically eliminated by Kentucky blue grass, white clover, and other grasses and weeds. At this station it was found that *in the absence of lime* continued application of ammonium sulphate induced conditions prohibitive to the successful growth of lettuce, spinach, beets, cress, cabbage, cauliflower, asparagus, cantaloupes (rock melons), clover, lucerne, beans, peas, vetch, Kentucky blue grass, timothy, etc. Blackberry, sorrell, water melon, and cranberry were found to be tolerant to the acid conditions induced.

A similar experience is reported from Woburn, England, where the soils are light and deficient in lime.

An extract from the Report, 1929, of the Rothamsted Experiment Station is given in Table 3.

TABLE 3.

Effect of applications of Nitrogenous Manures on Growth of Wheat and Barley with and without Lime at Woburn, England (51st year of the experiment). All plots received Superphosphate and Sulphate of Potash in addition to the Nitrogenous Manure.

Manuring.	Barley.				Wheat.			
	Plot.	Unlimed	Plot.	Limed.	Plot.	Unlimed.	Plot.	Limed.
		bus.		bus.		bus.		bus.
Sulphate of Ammonia ...	5a	5·8	5aa	15·0	5a	10·9	5b	13·3
Do. ...	8a	1·1	8aa	29·2	8a	2·7	8aa	7·9
Do. ...	8b	3·7	8bb	30·3	8b	2·9	8bb	9·4
Nitrate of Soda	6	30·6	...	...	6	12·8	...	...
Do.	9a	33·9	...	...	9a	17·2	...	...
Do.	9b	36·0	...	...	9b	17·0	...	...
No manure	1	11·1	...	...	1	20·4	...	...

At Rothamsted, where the soils are heavy and abundantly supplied with lime, no deleterious effects on crop yield from the continued use of ammonium sulphate have been noted. The chemical effect on the soils can be detected.

A long time experiment on the availability of nitrogenous fertilisers has been conducted at the New Jersey Agricultural Experiment Station and reported in a series of papers in "Soil Science" (Lipman, J. G., and Blair, A. W. (1920); Lipman, J. G., Blair, A. W., and Prince, A. L. (1925) (1928)). The soil was a loam, inclined to a gravelly phase, and was slightly acid in reaction, showing a lime requirement of 1,000 to 1,600 lbs. of CaO (hot lime) per acre. A rotation involving crops of maize, oats, wheat and timothy was arranged and continued from 1908 to 1927. The yields of wheat are selected as indicative of the trend of soil conditions and are reported in Table 4.

TABLE 4.

Yield of wheat at New Jersey Experiment Station under various manured treatments. All plots received superphospate and potash, except the no manure plots.

Plot.	Fertiliser Treatment.	Unlimed.			Limed.		
		1915.	1920.†	1925.	1915.	1920. †	1925.
		lbs./acre.	lbs./acre.	lbs./acre.	lbs./acre.	lbs./acre.	lbs./acre.
1	No manure	940	796	740	680	320	754
8	Sod. nitrate, 160lbs. per acre	1,120	1,036	1,303	1,100	1,068	1,444
9	Sod. nitrate, 320lbs. per acre	1,740	1,308	1,438	1,280	1,244	1,499
10*	Calcium nitrate ...	1,540	1,256	1,401	1,660	1,284	1,742
11*	Ammonium sulphate	1,280	56	101	1,600	1,360	1,735
12*	Cyanamide	1,460	1,452	1,879	1,500	1,432	1,849
13*	Dried blood	1,420	1,112	...	1,400	1,240	...

* Plots 10, 11, 12 and 13 received nitrogen equivalent to 320-lbs. sodium nitrate per acre.

† Barley was grown instead of wheat in 1920.

On the unlimed ammonium sulphate plots the timothy was almost entirely replaced by sorrell (Rumex acetosella) and crab grass (Digitaria sp.).

The effect of the fertiliser treatments on these plots is discussed by Blair and Prince (1922). Plate 1, from their paper, shows the effect of continued dressings of ammonium sulphate with and without lime on the growth of barley which was used in the rotation instead of wheat in 1920.

From Table 4 it is evident that, while ammonium sulphate is approximately equal to the other nitrogen fertilisers in the early stages, the soil eventually is rendered sterile for ordinary crops unless it is abundantly supplied with lime or a programme of liming to correct the acidity induced is followed.

Other ammonium salts require more or less attention on account of the tendency to promote soil acidity. Experiments show that ammonium phosphate and ammonium chloride are very similar to ammonium sulphate in this respect; ammonium nitrate and urea are quite mild. Pierre (1928) has shown that the depletion of lime in a soil resulting from the use of urea and ammonium nitrate is only about half that resulting from applications of ammonium sulphate.

In sympathy with the change in productivity the soil shows a chemical change as a result of the continued application of ammonium fertilisers. This change is particularly evident in the light textured, lime deficient soils and is reflected by soil reaction expressed in terms of pH. For the benefit of readers not familiar with the pH scale used to denote the degree of soil acidity, some few words of explanation may be in order.

Soil acidity or, for that matter, any acid condition is due to the presence of hydrogen in the electrified form, known to chemists as hydrogen ions. The concentration of these hydrogen ions (in grains per gallon for instance) is expressed by the pH scale. Hydrogen ions are present in all watery solutions. At the neutral point, as in pure water, the concentration of hydrogen ions, or acidity, is expressed as pH 7. If the solution is alkaline or basic—due, for instance, to washing soda or to lye—the concentration of hydrogen ions will be smaller and will be denoted as pH 10 or some figure higher than pH 7 determined by a special method of weighing the hydrogen ions. If the solution is acid, there will be a large concentration of hydrogen ions and the pH will be smaller than pH 7, say pH 5. Normal soils range from slightly acid to slightly alkaline; from about pH 5.5 to about pH 8.5. Soils which are more acid than pH 5.5 or more alkaline than pH 8.5 are likely to require special treatments in fertiliser and crop practice.

As a result of continued use of ammonium sulphate the soil becomes more acid; that is, the pH value decreases. In the experiments at New Jersey referred to the pH of the soil and subsoil decreased as follows, due to the application of this fertiliser at the rate of 247lbs. per acre for 20 years. The effect of other nitrogenous fertilisers containing an equivalent amount of nitrogen is noted and the results show a tendency to decreased acidity supporting the view that sodium nitrate, calcium nitrate, and cyanamide are physiologically alkaline fertilisers.

Plot.	Treatment.	pH.	
		Soil.	Subsoil.
1	No manure	5·3	5·6
11	Ammonium sulphate	4·8	4·0
9	Sodium nitrate	5·8	5·8
10	Calcium nitrate	5·8	5·7
12	Calcium cyanamide	5·8	5·8

In the sandy soils of the Darling Range even one small dressing of sulphate of ammonia has been found to increase slightly the acidity of the surface three inches of soil.

	Surface soil. pH.
Superphosphate only	6.41 (3 samples).
Superphosphate, 28lbs. amm. sulphate/ac. ..	5.76 (6 samples).

The question of the relation of nitrogen fertilisers and soil reaction has been investigated by Pierre (1928). The various fertilisers in the form of heavy dressing were added to soil which was then placed in pots and various crops grown over a period of years. The dose of fertiliser on each pot of soil was repeated each year. Two soil types were used to indicate the effect on a sandy loam as compared with a clay loam. The results are summarised in Table 5.

TABLE 5.

The effect of various Nitrogenous Fertilisers on Soil Reaction.

Source of Nitrogen.	pH Value.			
	Sandy Loam.		Clay Loam.	
	After 1 year.	After 2 years.	After 1 year.	After 4 years.
None	5·35	5·50	6·05	6·03
Sodium nitrate	5·60	6·25	6·25	6·60
Calcium nitrate	5·60	5·75	6·00	6·30
Calcium cyanamide ...	5·95	6·15	6·25	6·53
Ammonium nitrate ...	5·10	4·95	5·80	5·48
Urea	5·15	5·00	5·80	5·45
Ammonium phosphate ...	5·00	4·60	5·70	5·20
Ammonium sulphate ...	4·45	4·43	5·30	4·80

These experiments afford further evidence that severe acidity is induced by some ammonium salts when applied to soils. Light soils are more seriously affected than heavy soils.

Experiment shows that the various ammonium fertilisers require the following amounts of pure ground limestone or calcium carbonate to correct the acidity developed:—

1lb. ammonium sulphate requires 1.2lbs. calcium carbonate.

An equivalent of nitrogen as—

Ammonium phosphate requires 1.0lbs. calcium carbonate.

"Leuna" saltpetre requires 0.9lbs. calcium carbonate.

Urea requires 0.6lbs. calcium carbonate.

Ammonium nitrate requires 0.6lbs. calcium carbonate.

It is probable that the benefit of the lime will not be apparent in the early years, but sooner or later its advantage in conjunction with ammonium fertilisers will be apparent.

During the course of their growth plants make heavy demands on the available soil nitrogen and under conditions of intensive cultivation, particularly in

humid regions, applications of nitrogenous fertilisers are economical. Analysis of plants shows that the acidic radicles, such as nitrate and phosphate, are absorbed to a much greater extent than are the basic radicles such as lime and potash. Thus a wheat plant absorbs about three times as much acidic radicle as basic radicle. The behaviour in solution culture substantiates this observation from plants grown in the field, and shows that the nitrate is absorbed greatly in excess of all other radicles. For this reason nitrates are found to be physiologically basic fertilisers. The reaction may be represented as follows, using the base calcium as the example throughout:—

Calcium nitrate + plant + carbonic acid (from respiration) = calcium bicarbonate + plant protein.

The calcium bicarbonate is a basic constituent which will reduce soil acidity.

When ammonium salts are applied to the soil the nitrifying organisms very rapidly convert the ammonium nitrogen into nitrate nitrogen with the formation of acids.

1. Ammonium sulphate + oxygen + bacteria = 2 nitric acid + sulphuric acid + 2 water.
2. Ammonium nitrate + oxygen + bacteria = nitric acid + nitric acid + 1 water.
3. Ammonium phosphate + oxygen + bacteria = 3 nitric acid + phosphoric acid + 3 water.

These acids attack the lime and other basic compounds in the soil, forming—

Calcium nitrate.
Calcium sulphate.
Calcium phosphate.

As the nitrate is absorbed by the plant leaving the bulk of the lime in the soil, the acidity due to the nitric acid formed is small and is equivalent to the amount of calcium removed by the plant with the nitrate to supply its calcium needs plus the calcium nitrate and bicarbonate removed by leaching.

As sulphate and phosphate are absorbed to a very much smaller extent than nitrate, these acidic radicles are left in the soil, and it is believed that it is these strong acids which are mainly responsible for the depletion of the lime reserves of a soil and are *mainly* responsible for the soil acidity induced by the use of ammonium salts. Not being utilised by the plant to such a large extent as nitrate, the sulphates are removed with calcium by leaching and the phosphates form insoluble compounds in the soil with iron, aluminium, manganese, and calcium. This removes active bases from the soil, leading to acidic conditions.

It is realised that the reaction between the fertiliser and the soil is more complicated than is represented. However, the result of the complex reactions will yield the products mentioned and, for that reason, discussion of them may be omitted in this paper.

CONCLUSIONS.

Certain soil types in Western Australia benefit from an increased supply of nitrogen during the growing season of the crop. The supply may be augmented either by the use of nitrogenous fertilisers or the use of leguminous crops in rotation.

Sodium nitrate is likely to be deleterious after a period of years if used on the heavy alkaline soils of the drier districts. This fertiliser seems better adapted for lighter soils in wetter districts. Calcium nitrate is similar to sodium nitrate in its action and should be excellent under the wetter conditions. It should not have the deleterious effect on heavy soils owing to the lime it contains.

Ammonium salts are best adapted for the heavier textured soils containing adequate lime supplies. On light textured, lime deficient soils continuous use of ammonium fertilisers, particularly ammonium sulphate, ammonium phosphate, and ammonium chloride, leads to severe soil acidity. Ammonium nitrate and urea induce soil acidity but to a much smaller degree.

When ammonium fertilisers are employed on light soils the fertiliser programme must include systematic dressings of lime. The lime is applied once in four or five years in some practices.

Experiment shows that 1 pound of ammonium sulphate requires the application of 1.2 pounds of pure ground limestone or calcium carbonate to correct the acidity induced and to replenish the lime reserves of the soil. Similarly ammonium phosphate, urea, and ammonium nitrate containing nitrogen equivalent to 1 pound of ammonium sulphate require 1 pound, 0.6 pound, and 0.6 pound of pure calcium carbonate respectively to correct the acidity induced.

It is found in practice that nitrogenous fertilisers will not obviate the necessity for good cultural methods or the use of a leguminous crop in a rotation to maintain an adequate suppy of soil organic matter or humus.

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LEMON CURING.

Geo. W. Wickens,
Superintendent of Horticulture.

PICKING.

Gather the fruit when it reaches a diameter of $2\frac{1}{2}$ inches, and while still green or yellowish green. Do not store fruit which is fully yellow and tree ripe.

Each lemon should be clipped (not pulled) from the tree in such a manner as not to remove the "button" and this can best be done by making two cuts—one when severing the fruit from the branch, and another shortening the stem to about one-eighth inch in length before placing in picking box. Great care must be exercised when picking to prevent injury to the skin of the fruit, any abrasion of which is almost certain to result in mould infection.

Do not tip the fruit from a picking box into a sweat box, but handle each fruit separately throughout the operation of gathering and storing; best results will be obtained if the pickers use gloves and the picking boxes are padded.

No lemons should be stored which show skin blemishes from limb rubs, thorns, etc.

SWEATING.

After the fruit is gathered it should be placed loosely in boxes—petrol cases are suitable—and stacked in a well ventilated shed from three to seven days according to weather conditions being dry or damp, so as to allow the fruit to dry off, i.e., "sweat."

STORING.

When sweating is completed the fruit can be stored for curing in several ways, according to the number to be treated and the facilities the grower is able to afford.

Method No. 1.—Wrap each fruit in sulphite tissue paper—apple wraps—and pack loosely in cases lined with paper at bottom and sides and doubled over the top. Stack in a cool dark shed which must not be draughty. If shed cannot be darkened and draughts eliminated, cover the stacks of fruit with canvas sheets or bags, and during the early period of storage raise same occasionally at night,

preventing, as far as possible, great variations in temperature and humidity. Examine the fruit 14 days after storage, removing any showing signs of mould. This can be discerned without unwrapping the lemons. Examine again at later periods, the time of which will vary according to condition of fruit, but if it has been handled with care throughout, very little decay should be found.

Method No. 2.—After sweating, wrap each fruit in sulphite tissue paper. Line the storage cases with paper and pack fruit loosely in these using chaff as a filler as follows:—Just cover the bottom of the case with a layer of chaff, place thereon a layer of lemons; then fill spaces between and cover fruit with a further layer of chaff; then another layer of lemons and so on until case is filled. Stack, handle and examine in shed same as advised for cases packed without chaff.

Method No. 3.—After sweating place the fruit loosely and unwrapped in storage cases lined with paper. Stack cases in a shed free from draughts in blocks of 40 to 50 and cover these with canvas tents. Place a dish of water inside each tent, thus maintaining humidity and preventing excessive shrinkage from evaporation of fruit. If drops of moisture appear on surface of fruit, raise the sides of the tents until moisture has disappeared; then drop again into position. Examine the fruit periodically for mould infection.

Method No 4.—Underground cellars, if properly constructed, make satisfactory storage places, but require careful attention in preventing moisture from oozing through, or collecting on the walls and floor during winter rains, and an air circulation must be provided, that will allow of gases given off from the fruit being carried out of the chamber. Finally, it must be remembered that no matter what method of storage is adopted none will be successful if the fruit has been bruised or the skins scratched. Gathering the fruit at the right time and avoiding skin injury are essentials in successful lemon curing.

"THE JOURNAL OF AGRICULTURE"

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THE DIPPING OF SHEEP.

HUGH McCALLUM,
Sheep and Wool Inspector.

Parasites in sheep mean an economic loss and if not checked they will quickly result in a widespread deterioration of the State's wool clip.

From some of the clips seen on the Show Floors it would appear that the sheep "tick" is very prevalent in certain districts this season.

Farmers are very fortunate in that with the exercise of care when purchasing new sheep and the annual dipping of their own flocks, they can combat and practically eradicate the parasites "lice" and "tick."

Tick and lice live by sucking the blood from their unfortunate hosts and breed continuously on undipped sheep. Infested animals can be quickly picked out by their poor condition and the appearance of their fleeces. To allay the irritation caused by these parasites the sheep rub themselves along fences or against trees,

Sheep infested with Louse and Tick. Note torn and ragged condition of fleece, due to rubbing.

and often bite at their bodies, until the wool is torn off, leaving raw patches. These patches, in addition to lowering the wool poundage per head, become a menace in that they are attractive to a further serious pest—the blowfly.

For best results dipping should be carried out regularly each season from four to six weeks after shearing. Good standard poisonous preparations are available and the instructions supplied by the makers must be strictly adhered to. On no account must dipping be done during a period of extremely hot or cold weather, or when the animals are thirsty or over-heated from driving. Sheep are better

brought in handy to the dip and given water the evening before. The work should be commenced early on a dry warm day and completed at least two hours before sundown. Every animal put through the dip should be soaked for at least a minute and the head should be once immersed in the solution. This can be done by using a pole with a flat block on the end about 6in.-8in. square, with the corners rounded off. The block prevents injury to the sheep or the fleece when pushing the animal under.

Young lambs can be given only a half-length swim. After dipping, sheep should be held for at least half an hour in a draining pen to prevent the poisonous

Infested sheep, showing typical tufts of wool projecting over the uniform surface of fleece.

solution being dripped out over the pastures. When ewes have suckling lambs, the lambs should be kept apart for a few hours after dipping, but care should be taken to see that they are "mothered" before nightfall.

In districts where small flocks are pastured the cost of putting down individual dips is often rather more than an owner wishes to expend, and can be obviated by owners combining and putting in a community dip, conveniently situated, and sharing the cost.

Owners who have not yet dipped their flocks should give the matter immediate attention.

OWNERS OF BULLS.

Dairy Cattle Improvement Act, 1922.

Attention is drawn to the registration of all bulls over the age of nine months (with the exception of pedigree animals of beef strain) which is due on the 1st January, and must be effected not later than the 21st.

All group settlers whose holdings have been assessed are liable for the registration of the bulls in their possession, and should make application without delay.

The fee payable is 5s. per annum, and should be forwarded with the application form.

SOME OBSERVATIONS ON THE SEASONAL AND REGIONAL INCIDENCE OF BLOWFLIES IN THE SOUTH-WEST OF WESTERN AUSTRALIA.

L. J. Newman, F.E.S., Entomologist,
B. A. O'Connor, B.Sc. Agric., and
H. G. Andrewartha, B.Sc. Agric.

With the object of determining what species of blowflies are to be found in this area and their seasonal prevalence, a series of trapping or luring experiments were undertaken. The work commenced April, 1929, and terminated the end of March, 1930.

The area included is shown in the accompanying map, upon which is indicated the rainfall at each station. It represents that portion of the State lying between the 28th and 34th parallels of South latitude and West of the 119th parallel of East longitude.

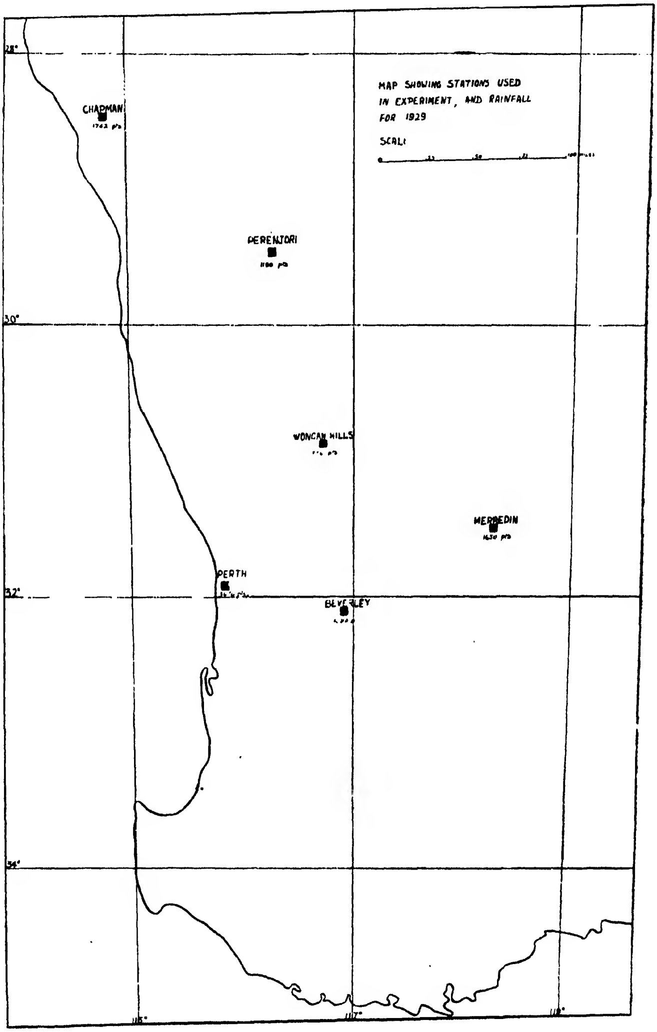
Very little has been written upon this subject to date.

Blowflies have been received and collected from many districts, but no actual and definite records have been previously published. The blowflies dealt with in this article are those commonly attracted to decaying meat, this being the bait used in all instances. Other flies also were attracted, but are not included.

Method of Collecting Data.—The State Experimental Farms were chosen in each of five tests, these centres being located in or near sheep areas and as evenly distributed as possible, the sixth area being the insectary grounds, Perth, representative of the coastal plain country. The monthly captures of flies were received from the following places:—

Chapman Experimental Farm.
Perenjori Experimental Farm.
Wongan Hills Experimental Farm.
Merredin Experimental Farm.
Avondale Experimental Farm (Beverley).
Perth Insectary Grounds.

On reference to the accompanying map, it may be seen at a glance where these collecting centres are situated.



Each farm manager who undertook to collect was supplied with a new Western Australian Blowfly Trap (see the Journal of the Department of Agriculture, Western Australia, Volume 3 (Second series) No. 3), together with instructions how to bait and set up and how to collect, pack, and forward the flies. The flies were forwarded regularly each month to the central laboratory, Perth. In one or two instances the catch was one or twice irregular, but the figures herein do afford a fairly correct record of the seasonal, regional, and relative abundance of the flies at different periods of the year. The capture each month was counted, the percentages of each species estimated, and the totals tabulated.

The flies that were determined in this investigation were the following:—*Lucilia sericata* (Meig.); *Chrysomyia rufifacies* (Macq.); *Calliphora australis* (Boisd.); *Microcalliphora varipes* (Macq.), and an undescribed species of Calliphora (referred to in this article as Calliphora sp.).

All other flies captured were placed under the heading of miscellaneous. These included:—*Peronia rostrata, Calliphora erythrocephala,* and several species of *Muscidae* and *Sarcophagidae.*

The following is a superficial description of each of the species of blowflies captured, which, it is hoped, will enable the farmer to recognise them.

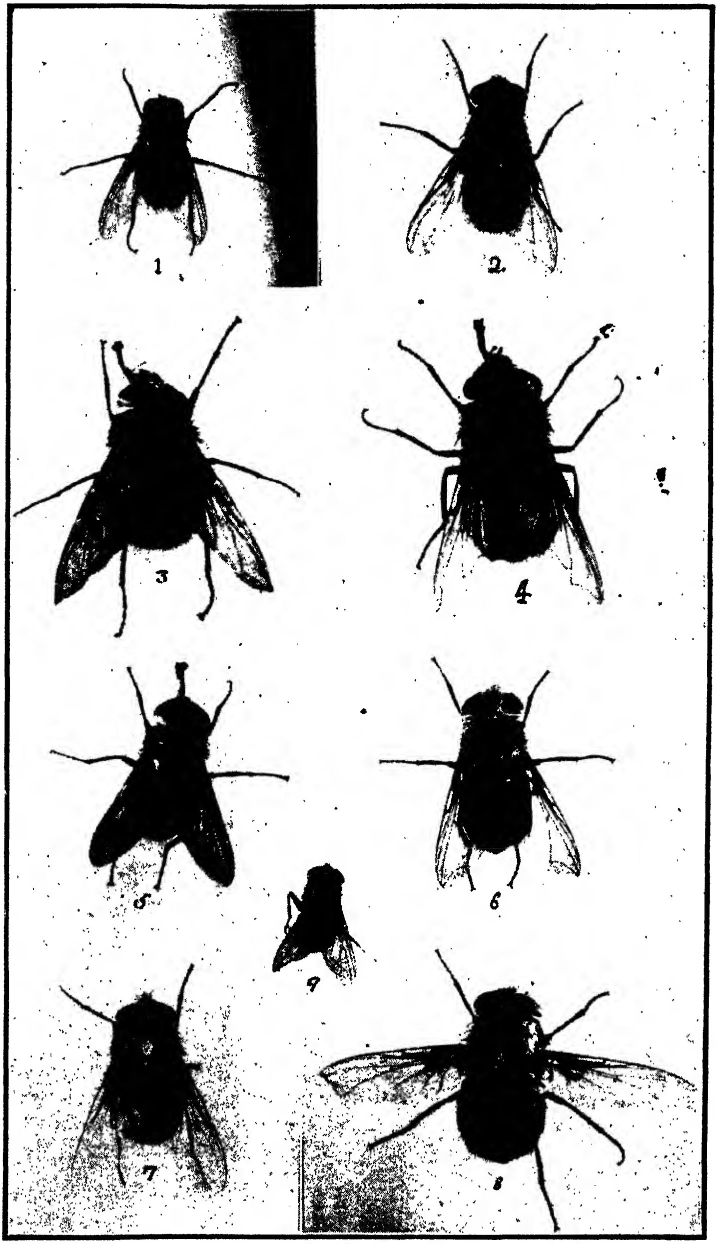
Lucilia sericata (Meig.).—The English Blue Bottle. It is a bright metallic green fly often tinged with blue and copper. The body is comparatively slender and somewhat bristly and it rests with its wings making a slightly greater angle to its body than do the wings of the closely resembling blue bottle, known as Chrysomyia rufifacies. The eyes are of a brownish red colour and in the case of the female are very widely separated, those of the male being slightly closer. The larva or maggot of this fly is smooth.

Chrysomyia rufifacies (Macq.).—Commonly known as the Banded Blue Bottle Fly. This fly is larger and more robust than the preceding one. Its prevailing colour is a bright shining green tinged with blue. The edges of the thoracic and abdominal segments are darker in colour than their central portions, giving the fly the characteristic transversely banded appearance, from which it derives its common name. The abdomen is more rounded than that of Lucilia sericata. The wings, when at rest, also lie more parallel to and over the body. The eyes are more globular than those of Lucilia, but of much the same brownish red colour. The female eyes are not so widely separated and those of the male are almost touching. The larvae or maggot is easily recognised; it is not smooth and white, but has the whole surface of the body covered with rows of protuberances, at the ends of which are set tufts of short spines. This gives it a characteristic hairy appearanc, hence it is generally referred to as the hairy maggot.

Microcalliphora varipes (Macq.).—The smaller Banded Bluebottle Fly. Superficially this fly resembles C. rufifacies in its colour and the banding of the abdomen. It is less than half the size of either the previously mentioned flies. The eyes of both male and female are widely separated. It has a similar hairy maggot of about half the size of C. rufifacies.

Calliphora australis (Boisd.).—The Golden Winter Blowfly. This is a large, thickset, yellow, heavy blowfly. It closely resembles *Calliphora Stygia* (Fabr.) and *Calliphora Hilli* (Patton), Eastern State forms, which have not yet been definitely proved to be present in Western Australia. It differs from C. stygia, in not having the facets of the upper half of the multiple eyes of the male enlarged. From C. Hilli it can be separated by the form of the hypopygium of the male and in having the eyes of the male more widely separated. The larva is a thickset smooth maggot.

Calliphora sp. (Nov.).—This resembles both C. Augur (Fab.), with which it was originally confused, and C. centralis (Mallock), but differs from both. It is less hairy, its abdomen is a clear honey yellow, except for a bright metallic blue-violet patch (larger than that found upon C. Augur), which occupies most of the posterior and dorsal sections of the abdomen. It further differs in having three pairs of presutural acrostichal bristles and in having a blue-violet central mark on the abdomen, instead of a blue-green. The dusting on the fourth



1. Lucilia sericata (English Bluebottle). Male. X 2.
2. Lucilia sericata (English Bluebottle). Female. X 2.
3. Calliphora australis (Golden Winter Blowfly. Male. X 2.
4. Calliphora australis (Golden Winter Blowfly). Female. X 2.
5. Chrysomyia rufifaces (Banded Bluebottle). Male. X 2.
6. Chrysomyia rufifaces (Banded Bluebottle). Female. X 2.

tergite is white instead of yellow. It differs also from C. centralis in the colour of the central portion of the abdomen and in the dusting on the fourth tergite. The larva or maggot is smooth.

We have now accounted for the blowflies captured during this survey. A study of the accompanying tables will show that there is a great disparity in the relative abundance of the several species in the different districts and seasons or months of the year.

Chrysomyia rufifacies, the Banded Blue Bottle Fly, is the predominating one in all districts throughout the warmer months (September to April). It is either completely absent or very scarce during the colder months of May to September. Its numbers show a marked increase in the spring, usually about September, and continues to rise to a peak period in January. It then begins to decrease and reaches its minimum in the winter. This fly is relatively slightly more plentiful in the inland districts. Taking it generally, however, it is the most uniformly distributed of all the species examined.

Lucilia sericata, or Common Blue Bottle Fly. This is plainly shown by the tables to be in the main a coastal fly. It is never numerous at Perenjori, Merredin, Beverley, or Wongan Hills, a few being recorded there during the spring and early summer. At Perth, which represents coastal country, this fly is present every month of the year. It reaches its peak in the mid-winter months and is at its minimum in mid-summer. It never constitutes less than 15 per cent. of the total blowflies captured. At the Chapman State Farm, the only other coastal station in this test, some 300 miles north of Perth, Lucilia sericata was numerous in the spring and early summer months, but completely absent in the late summer and autumn.

Calliphora australis appears to be the worst sheep maggot fly that we have. It is a winter and spring pest. It was found to be present at all the stations where the captures were made, but was most numerous at Beverley. It is completely absent during the summer months (December to March) at all stations except Perth. It makes its appearance in May and gradually works up to its maximum in August-September and dwindles away to its minimum in mid-summer.

Calliphora sp. nov. This apparently new species is mostly an inland fly. In Perth we never found more than a trace of it. The tables show it to be present throughout the year at Merredin and Wongan Hills. It is most numerous in the winter and early spring, becoming less active and fewer in numbers as the summer approaches. In most places it disappears entirely in the summer, appearing again in April or May, according to season, but as before mentioned is always present in small numbers throughout the summer in the Wongan Hills and Merredin districts.

Microcalliphora varipes is present at all of the stations for nine months of the year, disappearing during winter. It reaches its maximum in the autumn, dies down to its minimum in mid-winter, and rises again in the spring and summer.

PERTH INSECTARY.

Month.	Lucilia sericata.			Chrysomyia rufifacies.			Calliphora sp.			Calliphora australis.			Microcalliphora varipes.			Total Blow-flies caught.	Miscellaneous.	Total Flies.
	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.			
April ...	10,837	40·3	37·47	5,900	21·9	20·38	...	...	...	739	2·7	2·55	9,502	35·1	32·8	27,978	2,022	29,000
May ...	6,171	94·8	85·7	228	3·5	3·2	...	...	...	114	1·7	1·6	...	...	...	6,513	687	7,200
June ...	2,734	92·2	52·6	94	3·1	1·8	...	...	...	94	3·1	1·8	47	1·6	0·9	2,969	2,231	5,200
July ...	912	81·3	25·7	...	...	...	19	1·7	0·5	171	15·3	4·8	...	...	...	1,121	2,432	3,553
Aug. ...	892	55·1	27·1	...	...	...	...	...	...	720	44·4	21·9	...	...	...	1,620	1,665	3,285
Sept. ...	10,098	68·0	30·6	693	4·8	2·1	231	1·6	0·7	3,663	24·8	11·1	99	0·8	0·3	14,784	18,216	33,000
Oct. ...	8,772	50·0	20·4	2,021	11·4	4·7	...	...	...	6,192	34·8	14·4	673	3·8	1·6	17,558	25,442	43,000
Nov. ...	13,400	20·9	10·0	42,210	65·2	31·5	536	·9	·4	5,082	7·8	3·8	3,350	5·2	2·5	64,578	69,422	134,000
Dec. ...	15,397	24·2	17·3	40,673	64·7	45·7	1,780	2·9	2·0	890	1·5	1·0	4,005	6·7	4·5	62,743	26,255	89,000
Jan. ...	2,260	15·6	11·3	11,260	78·1	56·3	220	1·6	1·1	100	·5	·5	600	4·2	3·0	14,440	5,560	20.000
Feb. ...	5,076	46·0	42·3	4,884	44·2	40·7	192	1·8	1·6	...	...	...	888	8·0	7·4	11,040	960	12,000
March ...	5,852	15·3	13·3	11,000	28·7	25·0	132	·4	·3	...	...	...	21,296	55·6	48·4	38,280	5,720	44,000

MERREDIN EXPERIMENT FARM.

Month.	Lucilia sericata.			Chrysomyia rufifacies.			Calliphora sp.			Calliphora australis.			Microcalliphora varipes.			Total Blow-flies caught.	Miscellaneous.	Total Flies.
	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.			
April ...	200	3·8	1·0	2.400	46·1	12·0	300	5·9	1·5	...	...	...	2,300	44·2	11·5	5.200	14.800	20.000
May ...	21	2·1	1·2	299	29·1	17·0	450	43·8	25·6	86	8·4	4·9	170	16·6	9·7	1,026	734	1.760
June ...	49	2·3	0·7	...	...	...	1,778	77·3	25·4	364	16·0	5·2	105	4·4	1·5	2,296	4.704	7.000
July ...	6	1·9	1·4	...	...	...	191	62·0	43·7	111	36·1	25·4	...	...	...	308	129	437
Aug. ...	...	...	...	721	11·4	10·3	3,465	56·0	49·5	2,037	32·6	29·1	...	...	...	6.223	777	7.000
Sept. ...	1,080	6·4	4·8	6,000	36·5	27·3	7.680	47·6	34·9	1.580	9·5	7·2	...	...	...	16.340	5.660	22.000
Oct. ...	2,739	13·8	8·3	10,164	51·2	30·8	6,567	33·2	19·9	297	1·2	0·9	132	0·6	0·4	19,899	13.101	33.000
Nov. ...	150	2·0	1·5	5,500	74·3	55·0	1,650	22·3	16·5	...	...	...	100	1·4	1·0	7.400	2.600	10,000
Dec. ...	420	4·6	3·5	7,392	80·8	61·6	552	6·1	4·6	...	...	...	768	8·5	6·4	10,032	1.968	12,000
Jan. ...	45	1·9	1·3	2,034	80·5	58·1	115	4·6	3·3	...	...	...	326	13·0	9·3	2.520	980	3,500
Feb. ...	...	...	...	665	73·4	66·5	25	2·8	2·5	...	...	...	215	23·8	21·5	905	95	1,000
March ...	...	...	...	1,820	80·2	65·0	196	8·7	7·0	...	...	...	252	11·1	9·0	2.268	532	2.800

DAMPAWAH EXPERIMENT FARM (PERENJORI).

Month.	Lucilia sericata.			Chrysomyia rufifacies.			Calliphora sp.			Calliphora australis.			Microcalliphora varipes.			Total Blow-flies caught.	Miscel-laneous.	Total Flies.
	No. caught.	Percent-age of Total Blow-flies.	Percent-age of Total Flies.	No. caught.	Percent-age of Total Blow-flies.	Percent-age of Total Flies.	No. caught.	Percent-age of Total Blow-flies.	Percent-age of Total Flies.	No. caught.	Percent-age of Total Blow-flies.	Percent-age of Total Flies.	No. caught.	Percent-age of Total Blow-flies.	Percent-age of Total Flies.			
April ...	...	...	...	17,100	64·5	57	2,400	9·2	8·0	...	...	...	6,900	26·3	23·0	26,400	3,600	30,000
May ...	...	...	...	14,040	39·0	39·0	12,600	35·0	35·0	432	1·2	1·2	8,928	24·8	24·8	36,000	...	36,000
June ...	...	...	...	840	12·2	10·5	4,344	62·6	54·3	992	14·3	12·4	760	10·9	9·5	6,936	1,064	8,000
July ...	74	0·6	0·5	74	0·6	0·5	7,652	64·5	58·9	3,417	28·7	26·3	668	5·6	5·1	11,885	1,115	13,000
Aug. ...	...	...	...	504	1·5	1·4	24,516	74·4	68·1	7,128	21·7	19·8	756	2·4	2·1	35,748	252	36,000
Sept. ...	...	...	...	14,900	28·7	23·8	19,000	36·0	29·9	12,400	27·7	21·7	5,100	9·6	7·9	51,600	10,400	62,000
Oct. ...	1,020	2·1	1·7	32,760	60·5	54·6	15,240	28·7	25·4	...	...	...	3,660	6·7	6·1	52,680	7,320	60,000
Nov. ...	320	2·1	1·6	11,160	70·3	55·8	3,640	22·9	18·2	...	...	...	740	4·7	3·7	15,860	4,140	20,000
Dec. ...	54	·7	·7	5,670	80·7	63·0	315	4·6	3·5	...	...	...	990	14·0	11·0	7,029	1,971	9,000
Jan. ...	...	...	...	801	82·5	53·4	5	·3	·3	...	...	...	165	16·5	11·0	976	524	*1,500
Feb. † ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
March ...	...	...	...	6,128	46·0	38·3	...	...	...	...	...	...	7,200	54·0	45·0	13,328	2,672	16,000

* There were five C. erythrocephala in total. † Only 19 flies caught.

WONGAN HILLS EXPERIMENT FARM.

Month.	Lucilia sericata.			Chrysomyia rufifacies.			Calliphora sp.			Calliphora australis.			Microcalliphora varipes.			Total Blow-flies caught.	Miscel-laneous.	Total Flies.
	No. caught.	Percent-age of Total Blow-flies.	Percent-age of Total Flies.	No. caught.	Percent-age of Total Blow-flies.	Percent-age of Total Flies.	No. caught.	Percent-age of Total Blow flies.	Percent-age of Total Flies.	No. caught.	Percent-age of Total Blow-flies.	Percent-age of Total Flies.	No. caught.	Percent-age of Total Blow-flies.	Percent-age of Total Flies.			
April ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
May ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
June ..	...	...	...	75	20	0·4	150	40	0·8	75	20	0·4	75	20	0·4	375	3,375	3,750
July ...	...	...	...	1	0·6	0·3	114	53·0	32·3	100	46·4	28·3	...	...	...	215	138	353
Aug. ...	221	2·7	1·3	221	2·7	1·3	4,199	41·9	24·7	5,372	52·7	31·6	...	...	...	10,013	6,987	17,000
Sept. ...	114	1·3	0·3	2,470	26·3	6·5	3,724	40·0	9·8	2,888	31·1	7·6	114	1·3	0·3	9,300	28,690	38,000
Oct. ...	600	6·7	2·0	3,870	45·4	12·9	3,810	44·5	12·7	...	...	...	270	3·4	0·9	8,540	21,450	30,000
Nov. ...	1,166	8·4	2·3	9,333	67·5	18·66	2,833	20·5	5·66	...	...	...	500	3·6	1·0	13,667	34,333	50,000
Dec. ...	406	2·9	1·4	10,846	78·7	37·4	1,131	8·3	3·9	...	...	...	1,769	10·1	6·1	13,152	15,848	29,000
Jan. ...	30	3·0	1·0	540	54·0	18·0	30	3·0	1·0	...	...	...	400	40·0	13·3	1,000	2,000	3,000
Feb. ...	...	...	...	3,600	53·6	30·0	240	3·6	2·0	...	...	...	2,880	42·8	24·0	6,720	5,280	12,000
March ...	...	...	...	6,750	52·0	33·75	500	3·8	2·5	...	...	...	5,750	44·2	28·75	13,000	7,000	20,000

CHAPMAN EXPERIMENT FARM.

Month.	Lucilia sericata.			Chrysomyia rufifacies.			Calliphora sp.			Calliphora australis.			Microcalliphora varipes.			Total Blow-flies caught.	Miscel-laneous.	Total Flies.
	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.			
April ...	...	...	...	675	75·0	67·5	...	...	...	...	...	...	225	25	22·5	900	100	1,000
May ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
June ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
July ...	88	6·7	6·6	44	3·5	3·4	1,122	87·2	85·2	11	0·8	0·8	22	1·8	1·7	1,287	33	1,320
Aug. ...	58	1·4	1·3	466	11·9	10·9	3,627	82·2	80·6	232	5·5	5·3	...	...	...	4,383	117	4,500
Sept. ...	1,290	11·9	8·6	3,645	34·8	24·3	4.185	38·8	27·9	300	2·9	2·0	1,215	11·6	8·1	10,635	4,365	15,000
Oct. ...	3,984	50·7	33·2	2,796	35·6	23·3	828	10·6	6·9	...	...	...	240	3·1	2·0	7,848	4,152	12,000
Nov. ...	2,500	31·9	25·0	4,330	55·3	43·3	...	...	...	...	...	...	1,000	12·8	10·0	7,830	2,170	10,000
Dec. ...	14	9·1	3·6	106	66·6	26·5	...	...	...	...	...	...	39	24·3	9·6	159	241	400
Jan. ...	...	...	...	3,033	46·4	43·3	...	...	...	...	...	...	3,500	53·6	50·0	6,534	466	7,000
Feb. ...	...	...	...	3,235	64·7	64·7	...	...	...	...	...	...	1,765	35·3	35·3	5,000	...	5,000
March ...	...	...	...	3.840	31·6	24·0	...	...	...	...	...	...	8,320	68·4	52·0	12,160	3,840	16,000

AVONDALE EXPERIMENT FARM (BEVERLEY).

Month.	Lucilia sericata.			Chrysomyia rufifacies.			Calliphora sp.			Calliphora australis.			Microcalliphora varipes.			Total Blow-flies caught.	Miscel-laneous.	Total Flies.
	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.	No. caught.	Percentage of Total Blow-flies.	Percentage of Total Flies.			
April ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
May ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
June ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
July ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Aug. ...	...	...	...	...	...	...	370	8·7	7·4	3,935	91·3	78·7	...	...	...	4,305	695	5,000
Sept. ...	...	...	...	330	3·0	3·0	2,750	25	25	7,920	72	72	...	...	...	11,000	...	11,000
Oct. ...	56	1·0	·7	1,480	26·5	18·5	1,880	33·5	23·5	2,184	39·0	27·3	...	...	...	...	2,400	8,000
Nov. ...	...	...	...	7,605	70·8	39·0	2.632	24·5	13·5	370	3·4	1·9	136	1·3	·7	10,743	8,757	19,500
Dec. ...	...	...	...	9,600	93	64	420	4·1	2·8	...	...	...	300	2·9	2·0	10,320	4,680	15,000
Jan. ...	...	...	...	3,125	90·9	62·5	...	...	...	...	...	...	315	9·1	6·3	3,440	1,560	5,000
Feb. ...	...	...	...	2,835	67·7	56·7	180	4·4	3·6	...	...	...	1,165	27·9	23·3	4,180	820	5,000
March ...	...	...	...	3,000	65·9	60·0	333	7·3	6·7	...	...	...	1,220	26·8	24·4	4,553	447	5,000

Having determined the species of blowflies found in these areas, we are now endeavouring to discover the flies mainly responsible for the blowing of the sheep. To this end, we desire those interested to collect larvae from infested sheep and forward to this Department for breeding out and determination.

During the progress of the work to date, we have found that *C. australis* is the prevailing and most active sheep maggot fly.

Another interesting fact was the rearing of this fly from maggots infesting cow droppings. Whether this is more or less accidental, has yet to be proved.

A further useful feature disclosed was the effectiveness of trapping. Enormous numbers of flies were captured at each farm.

We wish to thank the Superintendent of the Experimental Farms and the Farm Managers for their great interest and assistance in attending to the traps and the forwarding each month of the captures, and Dr. Mackerras, Entomologist, Council for Scientific and Industrial Research, for kindly determining the flies.

BORDEAUX MIXTURE.

Simple Directions for its Preparation in either Small or Large Quantities.

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Ever since the discovery by Millardet of the strong fungicidal (fungus-killing) properties of a mixture of lime and bluestone—as a result of his chance observation in 1882, in the Bordeaux district of France, of the protective action of such a mixture against the dreaded "downy mildew" (*Plasmopara viticola*) of the grape—the mixture known as "Bordeaux" has been the leading spray material all over the world wherever fungous diseases have had to be combatted.

Although to some extent superseded of late years by Lime-Sulphur, especially as a summer spray on apples and stone fruits, and by such other substances as "dry-mix sulphur-lime," "atomic sulphur," "sulphur dust," "copper-lime dust," "copper carbonate-sulphur dust," etc., for certain diseases, it still remains ". . . the most widely known and the most generally useful of all spray liquids employed against parasitic fungi" (1).

GOOD QUALITIES OF BORDEAUX MIXTURE.

The great and lasting popularity of Bordeaux Mixture as a spray for the vine, and for most orchard, vegetable, and flower-garden plants, may be attributed very largely to its following good qualities:—

1. When properly prepared, it is remarkably adhesive to most types of stems, fruits and foliage. After it has once dried on the plant it can only be slowly removed by rains, dews, or other climatic influences.

2. It has a very high efficiency in preventing infection of the above-ground parts of plants by most types of fungi.

3. The cost of the ingredients required to make quite a large volume of spray is relatively low.

4. When used at the ordinary strength, it is quite harmless to most types of cultivated plants.

5. It has a decidedly tonic effect on the growth of most plant species, quite apart from its fungicidal action.

6. It is quite simple to prepare and safe to handle.

DRAWBACKS TO THE USE OF BORDEAUX MIXTURE.

1. Its main disadvantage is that the bluestone (copper sulphate), which is one of the essential ingredients, will speedily corrode iron or steel and all the other commonly-used metals or alloys except copper, brass or bronze. This difficulty is usually overcome, in practice, by dissolving the bluestone in wooden tubs or casks, and by using bronze, brass, or porcelain-lined spraying equipment and accessories. On a small household scale the copper sulphate may be dissolved in copper, brass, bronze, glass or earthenware vessels.

2. Another disadvantage is that Bordeaux Mixture has been found very apt to cause injury to the leaves and fruit of apple and most kinds of stone-fruit trees (especially peaches and Japanese plums), if applied in the spring or summer *after* the "spur-bursting" or "bud-bursting" stage. To overcome this disability in the case of apples, only very weak strengths and an excess of lime are recommended from the "pinking" stage onwards, or "lime sulphur" may be substituted for the later sprays.

Bordeaux Mixture should only be applied to plants liable to be injured by the spray during warm, dry weather, as injury is most likely to occur if the spray is used during, or just preceding, dull, humid, slow-drying climatic conditions. The addition of an efficient spreader (see section on spreaders near the end of this article) will also tend to lessen the danger of russetting the fruit or causing leaf injury. Further information *re* using Bordeaux Mixture as a spray for apples after the "spur-bursting" stage will be found on pages 254-263 of the June issue of this Journal for 1930, or on pages 17-23 of Department of Agriculture Bulletin No. 306, entitled "Black Spot or Scab of Apples and Pears in Western Australia."

There is no difficulty in this State so far as Bordeaux injury to stone fruits is concerned, inasmuch as all the fungous diseases which occur here, as yet, on such plants, can be readily controlled by spraying with Bordeaux Mixture in the winter, or just as the buds are bursting in the spring, or, in addition, as the leaves are falling from the trees in the autumn, as the case may be. If these sprayings are carried out efficiently, there is, at present, no necessity for the summer spraying of stone fruits in this State. Should such a necessity arise in the future, due to the outbreak of some otherwise uncontrollable parasite, "dry-mix sulphur lime" or "self-boiled lime-sulphur" could be used as convenient and harmless summer sprays.

3. The only remaining serious objection to the use of Bordeaux Mixture is that it imparts a bluish colouration to sprayed plants, so that it is sometimes considered unsightly on ornamental or flower-garden subjects, and it cannot, of course, be used on produce just prior to marketing. For this latter purpose, ammoniacal copper carbonate or very dilute Burgundy mixture (1 - 1½ - 50) should be used instead.

HOME PREPARATION OF BORDEAUX MIXTURE ADVISABLE.

Many farmers, orchardists, vignerons, vegetable-growers and home-gardeners in this State are under the erroneous impression that Bordeaux Mixture is difficult to prepare, and, in consequence, obtain their Bordeaux as a powder already mixed.

Numerous experiments the world over have indicated that commercial Bordeaux Mixtures are not as effective, or as adhesive, as the freshly-prepared, properly-made, home-made mixture. Considerable burning of fruit and foliage has sometimes followed the use of commercial Bordeaux powders in this State. Mason, in his "Spraying, Dusting and Fumigating of Plants" (3), writes, "Bordeaux Mixture is the one spray which, if used in any considerable quantities, should always be made on the farm, the commercial forms being of less value than the freshly-made products."

FORMULAE FOR MAKING BORDEAUX MIXTURE.

The formula in most general use, at the present time, for most vegetable, flower-garden and fruit plants, is that known as "4 – 4 – 50." This means 4 lbs. of bluestone and 4 lbs. of "freshly-burnt," "stone," or "quick" lime to every 50 gallons of the mixture.

This standard formula may be varied, so as to allow for a greater or less proportion of bluestone to lime, according as experience indicates to be necessary for the control of a particular disease and the avoidance of spray injury to the species of plant concerned. Thus 6 – 6 – 40 is used in Western Australia for the "bud-bursting," "pre-blossoming" and "fruit set" sprayings of the vine against "Anthracnose" (*Gloeosporium ampelophagum*), but later sprayings, if required, are given at 6 – 6 – 50, and I consider 2 – 5 – 50 all that would be permissible or necessary here for the summer spraying of apples against "black spot," should that disease become at all widespread (see Department of Agriculture Bulletin No. 306).

In all formulæ for the preparation of Bordeaux Mixture the first figure given is the number of pounds of bluestone, the second figure is the number of pounds of "freshly-burnt," "quick" or "stone" lime, and the final figure indicates the full number of gallons to which the mixture must be made up with water prior to spraying.

DIRECTIONS FOR PREPARING BORDEAUX MIXTURE IN SMALL QUANTITIES FOR HOME GARDENS.

A small quantity of Bordeaux Mixture of very nearly 4 – 4 – 50 formula (actually 4 – 4 – 48) can be prepared by taking:—

(1) 4 ozs. bluestone,

(2) 4 ozs. "freshly burnt," "stone," or "quick" lime,

and making up to a final volume of 3 gallons as indicated below:—

a. **Dissolve the bluestone in a wooden tub or wooden barrel, or a copper, bronze, brass, glass or earthenware vessel, using 1½ gallons of water.** The bluestone may be dissolved by suspending it overnight in the water in a piece of hessian, bagging or linen, from a stick placed across the mouth of the receptacle; or by heating the water and pouring it over the bluestone in the bottom of the receptacle, if the mixture is required in a hurry.

b. **Slake the quick-lime, which must be quite fresh and of good quality, in another container, by adding water a little at a time.** A small wooden cask is convenient, but, unlike the bluestone, an iron vessel such as a clean empty kerosene tin may be used in which to slake the lime. When slaked, make up to 1½ gallons with water. This suspension and partial solution of lime in water is known as "milk of lime."

c. **Pour the two liquids simultaneously through a copper, brass or bronze wire strainer into the spray outfit, or into a wooden or other non-corrosible container, and, after seeing that the volume is exactly three gallons, use immediately.**

An alternative method is to first strain the milk of lime into the spray outfit through a piece of bagging to remove any gritty particles or lumps which might clog the sprayer, and then pour in the bluestone solution, keeping the milk of lime well agitated while doing so. See that the final volume is correct and commence to spray immediately.

The bluestone solution and the milk of lime can be kept indefinitely, so long as they are kept separate and any evaporated water is replaced to each before using; but once they have been added to each other the spraying must be commenced immediately and continued until all the spray is used up, as Bordeaux Mixture soon deteriorates if left standing about after being made up.

Another important point to bear in mind is never to mix the solid lime and bluestone together before adding the water. The more dilute each constituent is before meeting the other, the better.

STOCK SOLUTIONS AS A MEANS OF REMOVING THE DRUDGERY FROM THE FREQUENT PREPARATION OF BORDEAUX MIXTURE.

It rarely happens that a single spraying is sufficient to control a disease in plants. Even in those cases where a single spraying carried out at the right time does suffice, as with "Shot-hole" of stone fruits in many places, the orchardist usually find that the different varieties are not all ready for spraying at the same time. This usually means that the spraying period is protracted and the grower becomes impatient at having to continually make up "from scratch" a fresh lot of spray. Frequently, also, a grower finds, on going to use his quicklime, that it has become air-slaked, with the result that a new lot of quicklime must be ordered for delivery in a hurry, with consequent fraying of tempers and the possibility of a lot of damage being done by disease, in the meantime, before the new lot arrives. A certain amount may be used out of the new consignment, and again deterioration may take place by the time the remainder is required.

Difficulties of the above nature may be readily avoided if the growers will only appreciate the following facts:—

Although, when once prepared, Bordeaux Mixture must be used immediately, the separate ingredients, i.e., the bluestone and the lime, can be kept in concentrated form in water for very long periods without deterioration taking place, and ready for use at a moment's notice.

METHOD OF MAKING UP THE STOCK SOLUTIONS.

The procedure is as follows:—

1. **Work out approximately how much bluestone and lime will be required to carry out your spray programme.** (It usually takes about 2 gallons of liquid to spray a well-grown apple, stone-fruit or citrus tree in this State for the control of fungous diseases, and anything from 100 to 150 gallons to cover one acre of vegetable crops such as almost fully-grown potatoes. Various factors will tend, however, to vary the amount required, and the experienced grower will know best just how much he will need for a particular area or job.)

2. **Then dissolve the bluestone in water in wooden casks or other non-corrosible containers at the rate of 1 lb. to every gallon of water.**

This can best be done by suspending the bluestone over-night, in a sugar bag or cut-down chaff bag, from a stick placed across the mouth of the cask and so arranged that the bluestone is just beneath the surface of the water. If wanted in a hurry, the crystals can be fairly readily dissolved by pouring hot water over them at the rate of about 2 gallons of hot water to every 6 lbs. of bluestone.

3. **Slake the "freshly burnt," "stone" or "quick" lime in other containers at the same rate as the bluestone, i.e., so that each gallon of the concentrate contains in it one pound of quick-lime.** This is done by adding water, a little at a time, until all the lime is slaked, and then bringing the water level up to the required height in the containers. Iron vessels are quite suitable to make the lime concentrate in, but wooden casks are generally used.

The New South Wales Department of Agriculture has carried out a series of experiments and finds that **lime may be stored under water even for periods of twelve months. There is a slight decrease in the effective lime amounting to about ¾ per cent., but this decrease is so slight as to be negligible (4).**

Only a little of the lime actually goes into solution, the major portion eventually sinking to the bottom of the container.

To check evaporation, a few drops of lubricating oil (not spraying oil) may be placed on the surface of each concentrate, and a mark should be made at the surface of each lot when it is finished with for the time being, so that any water which has evaporated may be replaced before using it again. Covers could also be placed over concentrates to prevent animals or children interfering with them, and they should be protected from rain, dust-storms, etc., when not in use.

PROCEDURE TO BE FOLLOWED WHEN MAKING THE BORDEAUX MIXTURE FROM THE CONCENTRATES.

There are two alternative methods which may be used for making the Bordeaux Mixture from the concentrates.

The first method is the simpler, but does not give quite as good a spray mixture as the second. The second method gives the best possible mixture, but involves the use of a little more equipment than the first.

FIRST METHOD.

a. **Stir the lime concentrate thoroughly, being especially particular at the sides and corners of the container, so as to get a uniform distribution of the lime in the water, and, when thoroughly well mixed, dip out the full amount required, remembering that, when well stirred, each gallon of lime concentrate contains the equivalent of one pound of quick-lime. Pour the lime into the spray tank through a piece of bagging, or, better still, a fine wire sieve containing 16-18 meshes to the inch, to remove any gritty or coarse particles which might tend to block up the spraying equipment.** (A copper, brass or bronze wire sieve is the best, as it can then also be used for the bluestone when the time comes.)

If 3 - 4 - 50 Bordeaux was being prepared, for example, and it was proposed to make 50 gallons, it is obvious that 4 gallons of lime concentrate would be required to be sieved into the spray tank, the lime requirement being always the second figure in the formula.

b. After sieving the lime concentrate into the spray tank, add water to the tank until it contains about three-quarters of the total volume of spray to be made; *i.e.*, in the specific case under consideration, fill up the tank to about 40 gallons.

c. Set the agitator going and strain in the required amount of bluestone concentrate, remembering again that each gallon of bluestone concentrate contains 1 lb. of solid bluestone.

For the 3 – 4 – 50 formula being discussed, then, we would need 3 gallons of bluestone concentrate to be sieved through the brass, copper or bronze sieve into the agitated and diluted lime in the spray tank. (There should really be no need to sieve the bluestone solution, except that small pieces of straw, etc., which might block up the sprayer, might have been blown into the solution during the storage period.)

d. We have now arrived at the stage where about 43 gallons of liquid, containing a light-blue flocculent precipitate, are in the spray tank. **If a spreader is to be used, it should now be added, and then the volume finally be brought up to 50 gallons with the necessary amount of water.**

Use the Bordeaux Mixture immediately, if possible, but if, for any unforeseen reason, it has to be kept standing for some time before use, first add to it one-eighth of an ounce of table sugar (cane-sugar) for every pound of bluestone which has been used. In the example being considered, $\frac{1}{8}$ oz. x 3 = $\frac{3}{8}$ oz. of table sugar would need to be used. The table sugar prevents the deterioration of the flocculent (flake-like) blue precipitate to which the Bordeaux Mixture owes its desirable qualities. (One heaping tablespoonful of table sugar equals one ounce.)

SECOND METHOD:

This method is preferable to the first, but necessitates two extra containers. The underlying principle is that the ideal Bordeaux Mixture can only be prepared if both the lime and bluestone concentrates are diluted as much as possible (i.e., in each case to half the total volume of the Bordeaux to be made) before running them together simultaneously through the brass, bronze or copper wire strainer into the spray tank.

In the case of the 3 – 4 – 50 formula under discussion, for example, 3 gallons of bluestone concentrate are diluted to 25 gallons, with water, in a second wooden barrel or other suitable container. Four gallons of lime concentrate are similarly diluted in a wooden or iron container to 25 gallons, and then both lots of the diluted materials are run together simultaneously through the non-corrosible sieve into the spray tank, by means of taps and rubber hoses let into the bottoms of the dilution vessels.

AN ELEVATED STAND VERY CONVENIENT.

For the most convenient preparation of Bordeaux Mixture a wooden stand should be erected handy to an overhead water tank or other source of water supply. The vessels to hold the concentrates and the diluted ingredients are placed on the stand, which is built of such a height that the tank on the spray outfit can be conveniently filled by the force of gravity. In this way all heavy lifting is obviated, the only liquids requiring to be lifted being the small quantities of concentrates required for every 50 gallons of mixture. Instead of a wooden stand a vertical cut through a hillside or earth bank may be made to allow the spray equipment to pull up in front of, but below the level of, the mixing site.

Fig. 1.—A good type of elevated stand for the preparation of Bordeaux Mixture and the convenient filling of the spray outfit. Stock solutions may be diluted in the two central barrels on the lower platform, and run into the spray tank through a large pipe and hose extending out from between the barrels. The stock solutions of copper sulphate (bluestone) and lime may be kept in other barrels on the lower platform, or in two large barrels on the top platform. It is better if the top platform is reserved for the water supply, which may be held in large barrels or an iron tank. If an iron tank (galvanised or otherwise) is used to hold the water supply, care should be taken that it is not splashed with the bluestone solution, or, better still, it should be well protected on the outside with good quality paint or tar to prevent corrosion.

(After Mason, "Spraying, Dusting and Fumigating of Plants.")

PURITY OF THE INGREDIENTS ESSENTIAL.

The bluestone bought should be of at least 98 per cent. purity. It should be in the form of large dark-blue crystals, and should not contain any appreciable amount of the greenish-coloured sulphate of iron which is sometimes met with in commercial samples of bluestone. It may be tested by dissolving a small quantity in water, dilluting this with extra water in a tumbler until it becomes a light-blue colour, adding a little ammonia and then stirring well. A pale-blue precipitate of copper hydrate is first formed, but this quickly dissolves, if enough ammonia is present, to give a very intense violet-blue colour. The formation of a reddish-coloured precipitate or sediment indicates the presence of iron.

With reference to the lime used for the preparation of Bordeaux Mixture, it is of extreme importance that the lime should be freshly burnt. To test whether this is so, or to see if it has become to any extent water- or air-slaked, a few lumps should be placed in a heap and sprinkled with water. Freshly-burnt lime will become very hot, give off a quantity of steam, gradually fall to pieces and crumble to a fine white powder. Some lime will not do this readily with cold water, but may do so if hot water is used. If the lime does not get hot enough to give off steam, even with hot water, it is unsuitable.

Water-slaked lime may be used, provided that it has only been slaked a day or two at the most, and that the correct adjustment is made to the formula. If using fresh water-slaked lime, increase the lime content of the formula by one-third to one-half extra. Air-slaked lime cannot be used under any circumstances.

In practice the best procedure is to very definitely specify "freshly-burnt" lime when ordering, and then to slake it immediately on its arrival and keep it under water until required, as described in a preceding section of this article.

TESTS FOR BORDEAUX MIXTURE.

Bordeaux Mixture is said to owe its valuable fungicidal properties to a basic copper sulphate from which the ordinary copper sulphate is reformed in very small quantities from time to time. These quantities are too small to harm the tissues of most plants, but are yet quite sufficient to kill the germinating seed bodies (*spores*) of harmful fungi. If, by some mischance, there should happen to be too little lime in the Bordeaux Mixture to completely turn the bluestone into the insoluble basic sulphate, considerable injury could be caused to any plants sprayed. While there should be very little likelihood of this happening if ordinary care is taken, each lot of Bordeaux Mixture made up should be tested, before using, in one or other of the following ways:—

Take a little of the Bordeaux Mixture in a glass vessel, add a few drops of acetic acid, and then add a few drops of a solution of ferrocyanide of potassium in water. (The strength of the ferrocyanide should be 4 ozs. in one pint of water. Both the ferrocyanide and the acetic acid are obtainable from any chemist.) Should any brown discolouration occur, the Bordeaux Mixture does not contain enough lime, and more lime concentrate must be added, until, on further testing, no discolouration is apparent.

A rough but useful test which can be made to see if the Bordeaux contains enough lime to neutralise the bluestone, is to dip the clean blade of a pen-knife, or a bright piece of iron such as a shiny nail into the mixture for several minutes. If the mixture does not contain sufficient lime, a reddish-brown deposit of copper will form on the iron and more lime should be added. *Always use a little too much lime rather than a little too little,* as quite a considerable excess of lime may be used without the fungicidal properties of the spray being markedly lowered.

THE USE OF SPREADERS WITH BORDEAUX MIXTURE.

Whenever Bordeaux Mixture is used, the spreading, wetting, and adhesive qualities of the spray will be very greatly improved by the incorporation of a special spray "spreader" or "sticker." In addition, the spray, on drying, will settle down into a very thin, well-distributed and more or less continuous layer,

rather than into a number of scattered spots. The fungicide will therefore prove more efficient with a "spreader" than without, as, where the spray dries up in spots, very little, if any, protection is afforded to the tissues in between. Where spreaders are used there is also very much less danger of damaging the leaves or fruit, for the reason that the concentration of the solid materials from the spray is never so intense at any one point as if no spreader is used. Moreover less spray is used as there is not such a tendency to hold the spray nozzles for some time in the one place to try and *force* the material to wet the tissues and stay on.

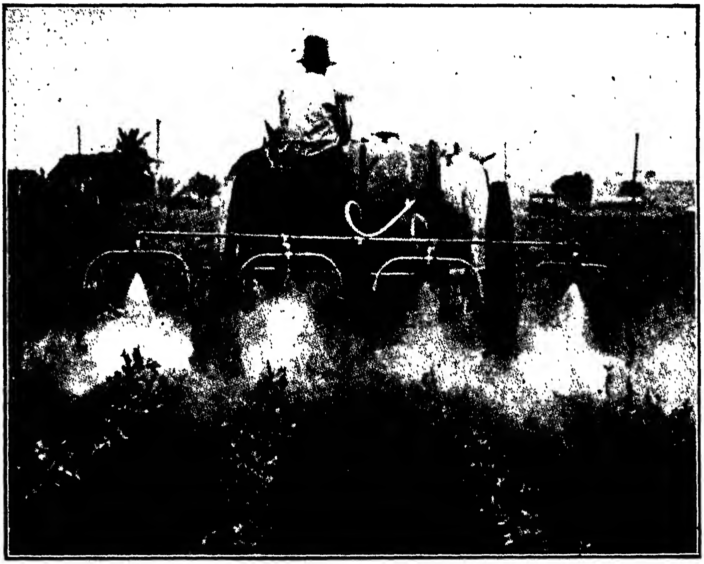

Fig. 2.—Spray boom of excellent type, showing the arrangement of nozzles to ensure thorough covering of such crops as potatoes, tomatoes, beans or similar plants grown in rows.

(*After Mason, "Spraying, Dusting and Fumigating of Plants."*)

CALCIUM CASEINATE SPREADER.

The following substances are some of those which have been used from time to time as spreaders or stickers in various sprays: oils, resins, soaps, glue, milk and molasses, but *calcium caseinate*, a by-product obtained from skim milk, is the only one which has become very popular or widely used. It should be used at the rate of one half to one pound (½—1lb.) per 50 gallons of spray. In mixing, make the required amount of calcium caseinate into a paste in a billycan, jug, or other suitable receptacle, by putting the caseinate into the dry container and then adding as much water by volume as there is caseinate. Stir, so as to form a thin paste (just in the same way as powdered skim milk is mixed by the experienced housewife for human use) and, when made into a paste, dilute with water and add to the mixture in the spray tank, keeping the agitator going during the process.

SPREADERS FOR BORDEAUX MIXTURE OTHER THAN CALCIUM CASEINATE.

If calcium caseinate is not obtainable, one or other of the following substances may be used instead:—

1. A good brand of *commercial powdered skim milk*, used at the rate of ½—1lb. for every 50 gallons as indicated above for calcium caseinate.

2. *Sweet skim milk*, used at the rate of half a gallon to every 50 gallons of spray.

3. *Flour*, used at the rate of ½—1lb. to every 50 gallons of spray. Mix with water to a thin paste and then add to the mixture in the spray tank.

4. *Glue*, ½oz. to every 50 gallons of spray. Dissolve in hot water and then add to the mixture in the spray tank.

5. *Good quality soft soap*, 2—3lbs. per 50 gallons of spray. Dissolve in water and add to the spray mixture in the spray tank, or barrel, *only just before the spray is to be used.*

6. "*Resin-Fish Oil*" *Soap*, 2—3lbs. per 50 gallons of spray. Dissolve in water and add to the spray mixture in the spray tank, or barrel, *only just before the spray is to be used.*

"Resin-Fish Oil" Soap is especially valuable as a sticker and spreader in Bordeaux Mixture for spraying smooth-leaved plants such as cabbages, onions, carnations, etc.

In using any spray spreader it is advisable not to make the spray liquid in the spray tank, or barrel, up to the full volume until *after* the spreader has been added, so that the strength of the fungicide will always be as much as possible the same whenever it is made up to the same formula. In other words, if making up a 3—4—50 Bordeaux, the *final* volume of spray after the spreader has been added, should be just 50 gallons. A mental attitude of exactness should be maintained all through the operations of preparing the Bordeaux Mixture. Carelessness or "slip-shod" methods in weighing out or preparing the materials, or in any other part of the operations, cannot be too strongly deplored.

FINAL NOTE.

Finally it should be pointed out that before using the spray apparatus, especially after it has been idle for any length of time, it should be thoroughly washed out to remove any chemicals which may have been left from the previous spraying. This is exceedingly important when the spray being used is a different kind from that previously employed, as, according to Cunningham (2), this mixing of different spray materials in the tank is one of the most frequent causes of spraying injury to plant tissues.

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(3) Mason, A. F.—"Spraying, Dusting and Fumigating of Plants." Macmillan Co., New York, 1929.

(4) New South Wales Department of Agriculture— "Spray Leaflet, No. 1, Bordeaux Mixture." Sydney, 1930.

HORTICULTURAL NOTES.

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When I arrived back from a tour through the fruit-growing districts recently, one of the first things that I opened in my correspondence was a note from the Editor of the "Journal" reminding me that a contribution for the December number was due, and that, as the issue would be in print at Christmas time, he suggested that an element of brightness in any articles submitted would be in keeping with the festive season. To-night when setting out to write these notes I am viewing the "bright" suggestion with rather mixed feelings. In the first place, the man on the land, and I speak as one who spent youth and early manhood coaxing, not always successfully, Mother Earth to yield to me of her riches, is not expected either at Christmas or any other period of the year to be noted for his brightness. Philosophy, and a hope that springs eternal for a time when the results of his labour will be something more nearly commensurate with the effort put forth, and a faith that the hoped for result is a thing of the near, not distant, future—these are the attributes of the tiller of the soil, and I have known them continue in many instances when hope deferred might reasonably have made the stoutest heart sick. Some of our orchardists within the last few weeks saw all chance of a return for twelve months' work vanish in a few days, and though they are meeting the knock with a philosophic grin, I doubt if there is much of either mirth or brightness behind it.

I am referring to the apple growers in those areas which suffered from thrips invasion, and where the light crop of last season was confidently expected to be followed by a heavy one this season. Now a second lean year must be battled through. Not all our apple growers, nor all apple growing districts have suffered, for although the pest was present in all districts and its mark "like the trail of the serpent" can be distinguished throughout, in some places the damage done is negligible; in others it is devastation. The big fruit area within 40 miles of Albany, including Mount Barker, suffered very severely, while in the South-West, from the Preston to Bridgetown and Manjimup, the crop is very good and there are some orchards carrying bigger quantities than in any previous season. The lighter rainfall districts are the worst affected, and quite a few miles eastward makes a considerable difference; for instance, Bridgetown crops on the whole are heavy, 18 miles eastward at Boyup Brook they are patchy, some good, some light, some nearly a failure; ten miles further east at Dinninup they are uniformly very light. In the Hills near Perth some damage has been done to "Yates," "Cleopatras," and "Dunn's," but there are no failures, and "Jonathans," "Granny Smith," and "Dougherty" are heavy.

I expected in this issue of the "Journal" to make my customary estimate of the apple and pear crops, but am desirous now of visiting the thrips affected area again before doing so. I anticipated prior to the arrival of the pest that the apple crop would approximate 2,250,000 bushels, and I am not clear yet how much to deduct for the losses caused by the insects, but I believe with the heavy crop in the South-West it may reach 900,000 bushels, or even more, but I will not make a definite estimate until I see Mount Barker again. One very "bright" feature is the number of sales f.o.r. at satisfactory prices which are being made where the crops are heavy. With the depressed condition in the world's markets for other primary products it is very cheering to find that apples are holding a good position.

The pear crop is light, particularly the two main export varieties "Winter Nelis" and "Josephine." "Bartlett's" are patchy, some places heavy, some medium, some light. As a whole the crop will be distinctly less than last season.

The stone fruit crop is much less than last year, particularly late varieties of apricots, peaches and English plums.

The grape crop—wine, drying, and table varieties—is good to heavy, and there is a comparative freedom at the present time from Black Spot, Anthracnose.

It is too early yet to judge what the citrus crop will be, but considering that last season there was a heavy one, the present indications are quite fair.

Stone fruit growers will be interested and disturbed to know that the market inspectors have already (2-12-30) condemned a number of cases of apricots on account of infection by fruit fly. There is no doubt the pest carried through the mild winter of this year easily in oranges, and the low prices and glut periods when navels were being marketed probably accounted for the failure to pick up windfalls as carefully as this might and should have been attended to. The light crop of late stone fruits will afford an opportunity to bring the pest under control, which it behoves all those interested to take full advantage of.

This completes the notes, and on reading them through I must confess I can see very little evidence of the brightness desired by the Editor, certainly not "bright"; perhaps not altogether "dark"; shall we say "drab"?

At any rate before relinquishing my pen I will wish the orchardists and vignerons of Western Australia—those on whom fortune has frowned equally with those on whom the fickle jade has smiled—a cheery Christmas and a New Year free from depression.

PEDIGREE SEED WHEAT AND OATS.

I. THOMAS,

Superintendent of Wheat Farms.

It has long been recognised amongst stock breeders how potent, for increasing the quality of their flocks and herds, is the use of stud animals selected specially for their productivity. Similarly, the value of the pedigree seeds of selected strains of plants chosen also for their high productivity and disease resistance, is now realised by up-to-date farmers.

One of the principal functions of the State Experiment Farms has been the production of selected pedigree seed of standard varieties of wheat and oats. In view of the special work and facilities required for the production and maintenance of the purity of this seed its cost is relatively high.

With a view to assisting the farmers in this present time of stress, and recognising that, owing to the abnormally low price of wheat ruling, some farmers may not be in a position to purchase selected pedigree seed, and will thus be prevented from taking advantage of the benefits to be derived from its use if the usual prices obtain, the Minister for Agriculture (Hon. P. D. Ferguson) has decided to make drastic reductions in them. This policy has been further influenced by an appreciation of the fact that the use of this seed is an important factor in promoting a greater yield per acre, and thereby reducing the costs of production.

With the exception of the new varieties "Bencubbin" and "Sutton" the prices will be as under—

Wheat—For 10 bag lots and over	...	12/- per bag of 3 bus.
Lots under 10 bags	....	14/- per bag of 3 bus.
Oats—For 10 bag lots and over	....	8/- per bag of 3 bus.
Lots under 10 bags	....	10/- per bag of 3 bus.

These will include rail freight to the siding nearest to the farmer's holding in the Wheat Belts.

The Department will have seed of the following varieties available—

Wheat	Baroota Wonder Early.	Nabawa.
	Carrabin.	Noongaar.
	Geeralying.	S.H.J.
	Gluyas Early.	Yandilla King.
	Merredin.	
Oats	Algerian.	Guyra.
	Burt's Early.	Mulga.

In addition to the above varieties it is also anticipated that there will be a small quantity of the new varieties of wheat "Bencubbin" and "Sutton" available, but the applications already received for these varieties are in excess of the quantity which it is expected will be available for distribution. The price of these varieties will be £1 per bag, freight paid, as in the case of the other varieties. As the quantity of seed of "Bencubbin" and "Sutton" wheat will be limited, and, owing to the large number of applications already to hand, it has been found necessary to limit the amount to be supplied to any one applicant to one bag.

Any farmers desirous of obtaining pedigree seed wheat and oats of the above varieties should forward their application direct to the Department of Agriculture at an early date.

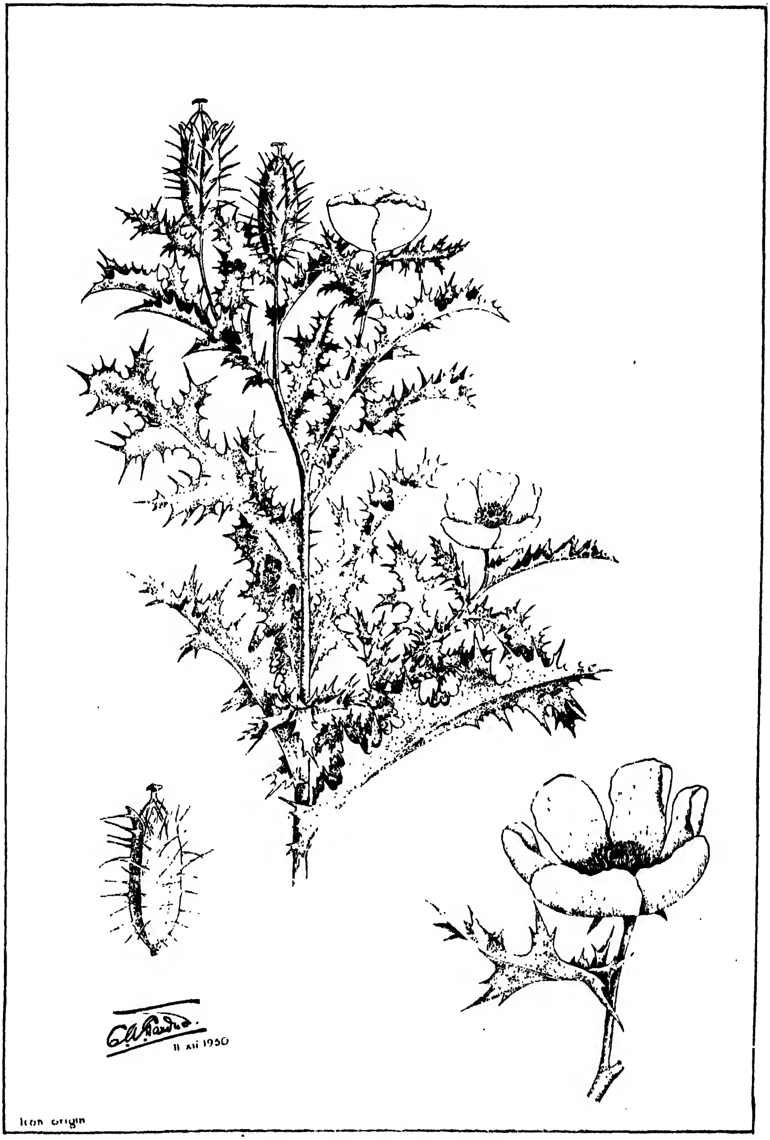
MEXICAN POPPY.

(*Argemone mexicana*, Linn.)

C. A. GARDNER, Government Botanist.

Mexican Poppy, as its name implies, is native to Mexico, its range extending northwards to Texas, and southwards to Central America. The plant is also known as Prickly Poppy. The genus, named after some classic plant the identity of which is now lost, contains ten species, all of which are American and some of them valued as garden plants with large white or yellow flowers.

This weed belongs to the Poppy family, and is therefore related to the plant which is the source of opium. Its yellow juice contains an alkaloid which gives reactions similar to morphia—a substance obtained from opium. The plant is poisonous, but apparently never eaten by stock since it is distasteful to horses, cattle and sheep, and in addition so prickly that it is naturally avoided. When cut with hay, the chaff fed to horses produces violent fits of gripes, according to New South Wales reports.



THE MEXICAN POPPY.

(*Argemone mexicana*, Linn.)

Mexican Poppy is a proclaimed noxious weed for the State of Western Australia. At the present time it is not very common, being reported from the following districts only :—Geraldton, Meekatharra, York and Toodyay. Notwithstanding this the plant is one which should be carefully eradicated whenever seen, since

it produces seeds freely, and is a very vigorous plant capable of flourishing under the most unfavourable conditions. In badly affected areas where the weed is dense, cultivation with a disc plough will be found effective. Smaller patches should be pulled by hand, or hoed out. Since the plant is an annual, it is essential for control that the plants should be prevented from seeding. This calls for the early recognition of the plant since it commences to flower at an early stage of growth, and continues to flower and seed until it dies. The seeds are produced in large numbers, and should these be formed and ripened on the plants, any efforts in the direction of eradication are wasted.

In the Mexican Poppy we have a plant which is a potential menace both to the pastoralist and the farmer. If it once becomes widespread it will undoubtedly be as serious as the Star Thistle. Early recognition of the plant when it first appears, and immediate destruction are the key to the problem in those districts in which the plant has not yet spread.

The Mexican Poppy can be distinguished readily by its prickly deeply lobed and white-blotched leaves, yellow poppy-like flowers and prickly 4–6–celled pod or capsule with numerous grey honey-comb-pitted seeds. The yellow juice which exudes freely when the stem is injured is another guide to identification.

OUTBREAK of DOWNY MILDEW ("Blue Mould") of TOBACCO.

The attention of farmers and growers is drawn to the following extracts from the *Government Gazette* of the 24th October last, with reference to tobacco seeds and plants:—

Distribution or Sale of Tobacco Seeds within Western Australia prohibited unless and until disinfected by, or under, the supervision of an Inspector under "The Plant Diseases Act, 1914."

"Plant Diseases Act, 1914."

ORDER IN COUNCIL.

WHEREAS it is enacted by Section 35 of "The Plant Diseases Act, 1914," that the Governor may make Regulations prescribing all matters which by this Act are required or permitted to be prescribed, or which it may be necessary or convenient to prescribe, for giving effect to this Act, and inter alia, prescribing the manner in which plants, fruits, and coverings in which plants and fruit have been contained or packed shall (whether infected or not) be treated in order to eradicate disease, or to lessen the risk of the spread of disease: And whereas certain Regulations were made under the said Act and published in the *Government Gazette* on the 16th day of September, 1921: And whereas Regulation 9 of such Regulations, prescribing fees payable for inspection and disinfection (if any) was amended by Order in Council published in the *Government Gazette* on the 1st day of April, 1926: And whereas it is now deemed expedient to amend the said Regulations by amending the said Regulation 9 as amended as aforesaid in the manner hereinafter mentioned, and by inserting a new Regulation as hereinafter mentioned: Now, therefore, His Excellency the Governor, acting with the advice and consent of the Executive Council, and in exercise of the power conferred by the said Act, doth hereby amend the Regulations made under the said Act and published in the *Government Gazette* on the 16th day of September, 1921, as follows:—

(1) By inserting in Regulation 9 as amended by Order in Council published in the *Government Gazette* on the 1st day of April, 1926, after the last item contained in the scale of fees ending "1s. 6d.," an item as follows:—
"For every ounce or part of an ounce of the seeds of the tobacco plant, 1s."

(2) By inserting after Regulation 48 a new Regulation as follows:—

"48A. No person shall sell, supply, distribute, deliver, or dispose of any seeds of the tobacco plant to any person, except an inspector appointed under 'The Plant Diseases Act, 1914,' unless and until such seeds have been inspected and disinfected by or under the supervision of an inspector appointed under the said Act and to his satisfaction."

Importation of Tobacco Seeds and Tobacco Plants into Western Australia prohibited.

WHEREAS it is enacted by Section 5 of "The Plant Diseases Act, 1914," that the Governor may by Proclamation prohibit, either absolutely or except in accordance with Regulations, the bringing into the State, either generally or from any specified State, country or place, any specified kind of plant, fruit, or other thing which would in his opinion be likely to introduce any disease into the State: And whereas, in the opinion of the Governor, tobacco plants and the seeds of the tobacco plant if brought into this State are likely to introduce disease into this State, and it is therefore deemed expedient to prohibit the bringing into the State generally from any other State, country, or place outside this State of tobacco plants and the seeds of the tobacco plant, except such tobacco plants and the seeds of the tobacco plant as may be required by the Department of Agriculture for its own purposes: Now, therefore I, the said Governor, acting with the advice and consent of the Executive Council, and in exercise of the power conferred by the said Act, do by this Proclamation prohibit the bringing into this State generally from any other State, country, or place outside this State of tobacco plants and the seeds of the tobacco plant, save and except such tobacco plants or the seeds of the tobacco plant as may be required by the Department of Agriculture for its own purposes.

LIVE STOCK AND MEAT.

For the information of readers of this "Journal," the following particulars have been supplied by Messrs. Elder, Smith, and Coy., Ltd., Perth.

METROPOLITAN FAT STOCK MARKETS, SEPTEMBER, OCTOBER AND NOVEMBER, 1930.

COMPARATIVE YARDINGS OF STOCK SALES.

	September.				October.					November.			
	3rd.	10th.	17th.	24th.	1st.	7th.	15th.	22nd.	29th.	5th.	12th.	19th.	26th.
Sheep	12,911	15,188	13,757	18,053	16,317	12,186	18,575	21,842	17,413	15,218	16,943	16,551	14,210
Cattle	668	1,050	808	546	421	430	601	714	641	641	481	741	704
Pigs	986	865	990	744	1,303	540	1,201	865	1,069	1,016	792	979	992

COMPARATIVE VALUES PER POUND.

	September.				October.					November.			
	3rd.	10th.	17th.	24th.	1st.	7th.	15th.	22nd.	29th.	5th.	12th.	19th.	26th.
	d.	d.	Shn. 3d. d.	Shn. 3d. d.	Shn. 2½d. d.	Shn. 2¾d. d.	Shn. 2¾d. d.	d.	d.	d.	d.	d.	d.
Mutton ...	5½	5¼	5	4½	3½	4	4	4	2¼	2½	3	3	3
Beef	5½	5¼	5	5½	6	6½	6	5½	5	4¾	5¾	5¼	4¾
Pork	7½	8	8	8	8	8	7¾	7¾	7½	5¼	5¾	6	6¼
Bacon	7½	7½	7½	7	7	7	6¾	6¼	5½	5¾	5¾	5¾	5¾

MARKET REPORT.

Messrs. H. J. Wigmore & Co., Ltd., of Wellington Street, Perth, have supplied us with the following information regarding chaff offered at auction in the Perth Railway Yards, for the period September to November (inclusive). In all cases the price quoted is for f.a.q. to prime wheaten chaff, packed in new bags:—

	Quantity.	Maximum per ton. £ s. d.	Minimum per ton. £ s. d.
September	1,185 tons	4 12 6	3 15 0
October	900 tons	4 2 6	3 15 0
November	1,000 tons	4 5 0	3 7 6

The period under review has been very disappointing from a grower's standpoint, qualities under f.a.q. to prime have been very difficult to quit at low prices. At the time of going to press the market value for f.a.q. to prime is from £3 7s. 6d. to £3 10s.; f.a.q., from £2 17s. 6d. to £3 2s. 6d. per ton; mediums are in very poor request to as low as from £2 10s. to £2 15s.; damaged and inferior, suitable for cow chaff only, is selling at from £2 7s. 6d. to £2 10s. per ton.

Oaten Chaff.—During the past three months heavy supplies were available, and low prices ruled. During September, f.a.q. was selling at £3 5s., and in the last week of this month this quality realised up to £4 5s. per ton. In October heavy supplies came forward, and the market was over-supplied; f.a.q. was sold at from £2 17s. 6d. to £3 per ton. During November the market firmed a little, and f.a.q. sold at from £3 10s. to £3 15s., but at the time of going to press values have eased somewhat; f.a.q. is now selling at from £3 5s. to £3 7s. 6d. per ton.

Oats.—The market has been over-supplied, and with a lesser demand auctioneers have been forced to quit consignments at very low rates, the undermentioned being the closing quotations:—

September—Good heavy feed Guyras, 1s. 7d. to 1s. 8d. per bushel; good feed, 1s. 5d. to 1s. 6d. per bushel; light feed, 1s. 3d. to 1s. 4d. per bushel.

October and November—Good heavy feed Guyras, 1s. 5d. to 1s. 6d. per bushel; good feed, 1s. 3d. to 1s. 4d. per bushel; light feed, 10d. to 1s. 1d. per bushel.

Wheat.—During September f.a.q. was selling at from 3s. 5d. to 3s. 6d. per bushel; second grade, from 2s. 11d. to 3s. 1d. In October f.a.q. was selling at from 3s. 1½d. to 3s. 3d., second grade at from 2s. 6d. to 2s. 9d. per bushel. During the early part of November f.a.q. sold at from 2s. 9d. to 2s. 11d., with an occasional truck at 3s. per bushel; but at the time of writing, however, the market has eased further: f.a.q. is now selling at from 2s. 5d. to 2s. 6d.; second grade at from 2s. 3d. to 2s. 4d.; smutty and inferior at from 1s. 9d. to 2s. per bushel.

METEOROLOGICAL INFORMATION.

Stations.	September, 1930. Temperature. Maximum. Mean.	Highest.	Minimum. Mean.	Lowest.	Rainfall. For Month.	Average.	October, 1930. Temperature. Maximum. Mean.	Highest.	Minimum. Mean.	Lowest.	Rainfall. For Month.	Average.	November, 1930. Temperature. Maximum. Mean.	Highest.	Minimum. Mean.	Lowest.	Rainfall. For Month.	Average.
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	72·6	91·7	49·5	40·3	1·21	1·64	75·9	88·4	49·8	41·5	0·84	0·96	86·3	99·4	55·3	40·9	0·14	0·29
Geraldton	72·4	94·5	54·6	42·6	0·98	1·37	73·5	86·8	54·3	46·8	0·88	0·71	77·1	100·4	59·6	49·4	0·08	0·26
Walebing	68·0	85·3	46·1	36·0	2·25	1·66	73·5	86·7	46·1	40·0	1·33	1·05	...	...	...	...	...	0·48
Perth	67·5	82·4	51·7	44·0	4·30	3·44	70·6	81·6	52·3	46·2	1·97	2·19	76·6	96·8	57·6	47·4	0·97	0·80
Kalamunda	65·0	81·2	49·6	40·5	5·72	4·64	69·9	81·2	49·4	41·2	2·15	3·20	77·0	95·1	54·2	46·1	1·34	1·06
Bunbury	64·8	80·0	49·3	39·0	2·66	3·71	67·3	75·0	49·6	39·0	2·55	2·43	72·2	90·2	54·3	41·0	0·83	1·02
Bridgetown	65·0	81·0	43·3	33·0	4·80	3·94	71·0	86·0	42·6	36·0	2·37	3·04	78·4	101·0	48·8	35·2	1·43	1·15
Albany	63·6	79·0	47·9	39·0	4·36	4·13	68·8	88·0	49·9	41·0	1·17	3·25	68·9	82·0	53·7	42·0	2·00	1·43
Merredin State Farm	69·1	88·1	44·1	33·5	0·65	0·94	75·7	86·9	46·6	35·0	0·34	0·77	84·4	97·8	53·5	43·0	0·01	0·46
Northam	70·1	89·8	47·7	39·0	1·45	1·62	74·9	86·0	47·8	40·0	0·57	0·99	83·0	99·0	54·9	42·0	0·03	0·40
York	68·5	87·0	45·6	36·2	1·25	1·61	75·0	88·0	45·6	38·0	0·18	1·04	82·7	100·5	52·6	40·0	0·08	0·43
Narrogin State Farm	64·5	80·1	43·4	32·8	2·05	2·31	71·0	83·4	42·9	33·0	0·63	1·45	79·3	96·5	48·4	35·8	0·25	0·60
Katanning	64·3	82·2	45·8	37·7	1·52	1·95	70·9	85·3	46·0	37·6	0·56	1·59	78·1	97·0	51·9	40·6	0·31	0·69
Cape Leeuwin ...	61·8	72·0	52·9	44·8	3·27	3·43	65·0	76·2	53·5	48·0	3·05	2·90	67·2	78·2	56·0	49·8	1·07	1·26

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No. 30.—*Descriptive Account of the Codlin Moth.* L. J. Newman.
No. 37.—*Conference of Producers,* 1910 *and* 1912.
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ENUMERATIO PLANTARUM AUSTRALIAE OCCIDENTALIS.

A Systematic Census of the Plants occurring in Western Australia.

CHARLES A. GARDNER,
Government Botanist.

MCMXXX.

PREFACE.

Western Australia is to-day the only State of the Australian Commonwealth which does not possess a text book dealing with its own flora. The official standard work is still Bentham's "*Flora Australiensis,*" published between 1863 and 1878. All subsequent work dealing with the plants of the country has been published either in small papers printed by various societies within Australia, or included in monographs published abroad. For many years past there has been an increasing demand for a Flora of Western Australia, or failing this a list of the species which have been described with references to the publications in which they may be found. Although Bentham's "*Flora Australiensis*" deals with about seventy-five per cent. of our indigenous species, the additions are important as representing in many cases common inland plants, and in addition the nomenclature has been much altered with the advancement of our knowledge, not to mention the changes which have been necessitated by the International Rules governing Nomenclature, so that Bentham's Flora, from the point of view of nomenclature, is now obsolete.

With the exception of a list of plants prepared by Dr. A. Morrison for the Western Australian Year Book for 1901, no sequential list of the plants indigenous to this State has hitherto been published, and it is hoped that this Census may supply a long felt want.

The arrangement of the families and genera in this work is taken from Engler's Classification as given in *Die Naturlichen Pflanzenfamilien*, the only exception being the division of the family *Leguminosae* into the three families as suggested by J. Hutchinson in his "Families of Flowering Plants" (1926). The Rules governing nomenclature have been faithfully observed, and in consequence many well-known species are given new names. The want of a good reference library has made portions of the work extremely difficult, and for the older species, specially those of Linnæus, I have been compelled to quote from more recent works concerning the name and date of the species in question.

The introduced naturalised flora has been dealt with, all the recorded species being included. These are given in italics, and instead of the name and date of the publication in which they were described, I have given the country of origin as shown in the "Index Kewensis."

It was originally intended to include geographical references, and also references to the "*Flora Australiensis,*" but it was found that this would either necessitate making this work inconvenient in size, or interfering with its compactness, and thus no references to Bentham's work are given, but wherever the name of a species differs from that given in the "*Flora Australiensis,*" the synonym as quoted in Bentham's work is given in italics following the original reference.

To Mr. H. G. Elliott, Assistant Plant Pathologist of the Department of Agriculture, I am indebted for assistance in tracing references, and to Mr. G. R. Meadly for assistance in making the Index, and correcting proofs.

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SYSTEMA FAMILIARUM.

Secundum Engler.

EMBRYOPHYTA ZOIDIOGAMA.

PTERIDOPHYTA.

I. FILICALES.
- a. Leptosporangiatae.
  - i. *Eufilicineae.*
    - 1. Polypodiaceae.
    - 2. Parkeriaceae.
    - 3. Gleicheniaceae.
    - 4. Schizaeaceae.
  - ii. *Hydropteridineae.*
    - 5. Salviniaceae.
    - 6. Marsileaceae.
- b. Ophioglossales.
  - 7. Ophioglossaceae.

II. LYCOPODIALES.
- a. Eligulatae.
  - 1. Lycopodiaceae.
- b. Ligulatae.
  - 2. Selaginellaceae.

III. PSILOTALES.
- 1. Psilotaceae.

IV. ISOETALES.
- 1. Isoetaceae.

EMBRYOPHYTA SIPHONOGAMA

GYMNOSPERMAE.

- a. Cycadales.
  - 1. Cycadaceae.
- b. Coniferae.
  - 1. Podocarpaceae.
  - 2. Cupressaceae.

ANGIOSPERMAE.

I. MONOCOTYLEDONEAE.
- a. Pandanales.
  - 1. Typhaceae.
  - 2. Pandanaceae.
- b. Heliobiae.
  - 1. Potamogetonaceae.
  - 2. Naiadaceae.
  - 3. Aponogetonaceae.
  - 4. Scheuchzeriaceae.
  - 5. Alismaceae.
  - 6. Hydrocharitaceae.
- c. Glumiflorae.
  - 1. Gramineae.
  - 2. Cyperaceae.
- d. Principes.
  - 1. Palmae.
- e. Spathiflorae.
  - 1. Araceae.
  - 2. Lemnaceae.
- f. Farinosae.
  - 1. Flagellariaceae.
  - 2. Restionaceae.
  - 3. Centrolepidaceae.
  - 4. Xyridaceae.
  - 5. Eriocaulaceae.
  - 6. Commelinaceae.
  - 7. Pontederiaceae.
  - 8. Philydraceae.
- g. Liliiflorae.
  - 1. Juncaceae.
  - 2. Liliaceae.
  - 3. Haemodoraceae.
  - 4. Amaryllidaceae.
  - 5. Taccaceae.
  - 6. Dioscoreaceae.
  - 7. Iridaceae.
- h. Microspermae.
  - 1. Burmanniaceae.
  - 2. Orchidaceae.

II. DICOTYLEDONEAE.
- A. Archichlamydeae.
  - a. Verticillatae.
    - 1. Casuarinaceae.
  - b. Urticales.
    - 1. Ulmaceae.
    - 2. Moraceae.
    - 3. Urticaceae.
  - c. Proteales.
    - 1. Proteaceae.
  - d. Santalales.
    - 1. Santalaceae.
    - 2. Opiliaceae.
    - 3. Olacaceae.
    - 4. Loranthaceae.
  - e. Polygonales.
    - 1. Polygonaceae.
  - f. Centrospermae.
    - 1. Chenopodiaceae.
    - 2. Amarantaceae.
    - 3. Nyctaginaceae.
    - 4. Phytolaccaceae.
    - 5. Aizoaceae.
    - 6. Portulacaceae.
    - 7. Caryophyllaceae.
  - g. Ranales.
    - 1. Nymphaceae.
    - 2. Ranunculaceae.
    - 3. Menispermaceae.
    - 4. Myristicaceae.
    - 5. Lauraceae.
    - 6. Hernandiaceae.
  - h. Rhoeadales.
    - 1. Papaveraceae.
    - 2. *Fumariaceae.*
    - 3. Capparidaceae.
    - 4. Cruciferae.
    - 5. *Resedaceae.*
  - i. Sarraceniales.
    - 1. Droseraceae.

k. Rosales.
1. Crassulaceae.
2. Cephalotaceae.
3. Saxifragaceae.
4. Pittosporaceae.
5. Byblidaceae.
6. Cunoniaceae.
7. Rosaceae.

l. Leguminales.
1. Mimosaceae.
2. Caesalpiniaceae.
3. Papilionaceae.

m. Geraniales.
1. Geraniaceae.
2. Oxalidaceae.
3. Linaceae.
4. Zygophyllaceae.
5. Rutaceae.
6. Burseraceae.
7. Meliaceae.
8. Tremandraceae.
9. Polygalaceae
10. Euphorbiaceae.
11. Callitrichaceae.

n. Sapindales.
1. Anacardiaceae.
2. Celastraceae.
3. Stackhousiaceae.
4. Sapindaceae.

o. Rhamnales.
1. Rhamnaceae.
2. Vitaceae.

p. Malvales.
1. Tiliaceae.
2. Malvaceae.
3. Bombacaceae.
4. Sterculiaceae.

q. Parietales.
1. Dilleniaceae.
2. Guttiferae.
3. Elatinaceae.
4. Frankeniaceae.
5. Cochlospermaceae.
6. Violaceae.
7. Passifloraceae.

r. Myrtiflorae.
1. Thymelaeaceae.
2. Lythraceae.
3. Sonneratiaceae.
4. Lecythidaceae.
5. Rhizophoraceae.
6. Combretaceae.
7. Myrtaceae.
8. Melastomaceae.
9. Onagraceae.
10. Halorrhagaceae.

s. Umbelliflorae.
1. Araliaceae.
2. Umbelliferae.

B. *Sympetalae.*

a. Ericales.
1. Epacridaceae.

b. Primulales.
1. Myrsinaceae.
2. Primulaceae.

c. Plumbaginales.
1. Plumbaginaceae.

d. Ebenales.
1. Sapotaceae.
2. Ebenaceae.

e. Contortae.
1. Oleaceae.
2. Loganiaceae.
3. Gentianaceae.
4. Apocynaceae.
5. Asclepiadaceae.

f. Tubiflorae.
1. Convolvulaceae.
2. Hydrophyllaceae.
3. Boraginaceae.
4. Verbenaceae.
5. Labiatae.
6. Solanaceae.
7. Scrophulariaceae.
8. Bignoniaceae.
9. Pedaliaceae.
10. Orobanchaceae.
11. Lentibulariaceae.
12. Acanthaceae.
13. Myoporaceae.

g. Plantaginales.
1. Plantaginaceae.

h. Rubiales.
1. Rubiaceae.

i. Cucurbitales.
1. Cucurbitaceae.

k. Campanulatae.
1. Campanulaceae.
2. Lobeliaceae.
3. Goodeniaceae.
4. Brunoniaceae.
5. Stylidiaceae.
6. Compositae.

ENUMERATIO PLANTARUM AUSTRALIAE OCCIDENTALIS.

Auctore.

C. A. GARDNER.

PTERIDOPHYTA.

FILICALES.

Polypodiaceae.

1. *DRYOPTERIS,* Adans, Fam. des. Pl. ii. 20 (1763).
D. gongylodes, (Schkuhr.) O. Kuntze Rev. Gen. ii. 81, 811 (1891) (*Aspidium unitum,* Swartz.)

2. *NEPHROLEPIS,* Schott, Jen. fil. t. 3 (1834).
N. exaltata, (Linn.) Schott. Jen. fil. t. 3 (1834).

3. *MICROLEPIA,*
M. speluncae, (Linn.) Moore, Ind. xciii. (1857) (*Davallia speluncae,* (L) Bak.)

4. *SCHIZOLOMA,* Gaud.
S. ensifolium, J. Sm. Journ. of Bot. iii. 414 (1841) (*Lindsaya ensifolia,* Sw.)

5. *LINDSAYA,* (Dryand) J. Sm. Mem. Acad. Turin. v. 413 (1793).
L. linearis, Swartz. Schrad. Journ. 1800 78 (1801).

6. *ASPLENIUM,* Linn. Gen. Pl. 783 (1737).
A. flabellifolium Cav. Descr. 257 (1802).
A. praemorsum, Swartz. Prodr. 130 (1788). (*A. furcatum,* Thunb.)
A. bulbiferum, Forst. Prodr. 80 (1786).

7. *PLEUROSORUS,* Fee. Gen. Fil. 179 (1850-52).
P. rutifolius, (R.Br.) Fee. Gen. Fil. 180 (1852) (*Grammitis rutaefolia* R.Br.)

8. *BLECHNUM,* Linn. Sp. Pl. ii. 1077 (1753).
B. orientale, Linn. Sp. ed. ii. 1535 (1763).

9. *STENOCHLAENA,* J. Sm. Journ. of Bot. iii. 401 (1841).
S. palustris, (Burm.) Bedd. Fern. Br. Ind. suppl. 26 (1876). (*Acrostichum scandens,* Hook.)

10. *GYMNOPTERIS,* Bernh.
G. Reynoldsii, (F. v. M.) C. Christens, Ind. Fil. 341 (1906) (*Annogramma Reynoldsii.* F. v. M.)

11. *PITYROGRAMMA,* (Link.) Domin de la Fact. Sci. l'Univ. Charles, Prague. 88.3 (1928).
P. leptophylla, (Linn.) Domin de la Fac. Sci. Univ. Charles, Prague. 88.9 (1928).

12. *CHEILANTHES,* Swartz. Syn. Fil. 5 126 (1806).
C. Brownii, (Desv.) Domin Biblio Bot. 85 133 (1913).
C. distans, (R.Br.) Mett. Cheil. 25 n. 19 (1859).
C. tenuifolia, (Burm.) Swartz. Syn. Fil, 129. 332 (1806).

13. *ADIANTUM,* Linn. Gen. Pl. 782 (1737).
A. lunulatum, Burm. Fl. Ind. 235 (1768).
A. aethiopicum, Linn. Syst. Nat. ed. x. ii. 1329 (1759).

14. *PTERIS,* Linn. Hort. Cliff. 443 (1737).
P. longifolia, Linn. Sp. Pl. ii. 1074 (1753).

15. *PTERIDIUM,* Gled. Scop. Fl. Carn. 169 (1760).
P. aquilinum, (Linn.) Kuhn. v. Deck. Reisen. iii. 3; bot. 11 (1879). (*Pteris aquilina*).

16. *POLYPODIUM,* Linn. Gen. Pl. 784 (1753).
P. phymatodes, Linn. Mant. 306 (1771).

17. *ACROSTICHUM,* Linn. Gen. Pl. 785 (1753).
A. aureum, Linn. Sp. Pl. ii. 1069 (1753).

Parkeriaceae.

1. *CERATOPTERIS*, Brong. in Bull. Soc. Phil. 186 (1821).
   C. thalictroides, Brongn. in Bull. Soc. Phil. 186 (1821).

Gleicheniaceae.

1. *GLEICHENIA*, J. Sm. in Mem. Acad. Turin. v. 419 (1793).
   G. linearis, (Burm.) Clarke in Trans. Linn. Soc. ii. bot. i. 428 (1880) (*G. dichotoma*, Hook).
   G. microphylla, (R.Br.) Christ, Frankr. d. Erd. 339 (1897) (***Platyzoma microphylla***, R.Br.)

Schizaeaceae.

1. *SCHIZAEA*, J. Sm. in Mem. Acad. Turin v. 419 (1793).
   S. fistulosa, Labill. Nov. Holl. Pl. ii. 103 (1906).
2. *LYGODIUM*, Swartz, Schrad. Journ. 1800. 106 (1801).
   L. scandens, (Linn.) Swartz, in Schrad. Journ. 1800, 106 (1801).

Salviniaceae.

1. *AZOLLA*, Lam. Encycl. Meth. i. 343 (1783).
   A. filiculoides, Lam. Encyc. Meth. i. 343, var. rubra, Diels.

Marsileaceae.

1. *MARSILEA*, Linn. Gen. Pl. 799 (1753).
   M. Brownii, A. Braun, Monatsbr. Acad. Berol. 418 (1863) (***M. quadrifolia***, Benth.)
   M. angustifolia, R.Br. Prodr. 167 (1810).
   M. hirsuta, R.Br. l. c. 167.
   M. Drummondii, A. Braun, in Linnaea xxv. 721 (1852).
2. *PILULARIA*, Linn. Sp. Pl. ii. 1100 (1753).
   P. Novae-Hollandiae, A. Br. Monatsber Akad. Berol. 435 (1863) (***P. globifera***, Benth.).

OPHIOGLOSSALES.

Ophioglossaceae.

1. *OPHIOGLOSSUM*, Linn. Gen. Pl. 503 (1753).
   O. coriaceum, A. Cunn. in Hook Comp. Bot. Mag. ii. 361 (1836) (***O. vulgatum***, Benth.).

LYCOPODIALES.

Lycopodiaceae.

1. *PHYLLOGLOSSUM*, Kunze in Mohl et Schlecht. Bot. Zeit. 721 (1843).
   P. Drummondii, Kunze in Mohl et Schlecht. Bot. Zeit. 721 (1843).
2. *LYCOPODIUM*, (Rupp.) Linn. Gen. Pl. 503 (1753).
   L. Drummondii, Spring. Monogr. Lycop. ii. 35 (1849).
   L. cernuum, Linn. Sp. Pl. ed. 2. ii. 1566 (1763).

Psilotaceae.

1. *PSILOTUM*, Swartz. in Schrad. Journ. in ii. 109 (1800).
   P. nudum (Linn.) Griseb. in Veget. d. Karaiben 130 (1857) (***P. triquctrum***, Sw.).

Selaginellaceae.

1. *SELAGINELLA*, Beauv. Prodr. des. Fam. de L'Aeth. 101 (1805).
   S. Preissiana, Spring. Monogr. Lycop. ii. 61 (1849).
   S. uliginosa, Spring. l. c. 60.
   S. proniflora, (Lam.) Baker in Journ. Bot. xiv. 156 (1885). (***S. Belangeri*** Spring.).

Isoetaceae.

1. *ISOETES*, Linn. Skanska Resa 420 (1751).
   I. Drummondii, A.Br. in Berol. Monatsber 593 (1863).

GYMNOSPERMAE.

CYCADALES.

Cycadaceae.

1. *CYCAS*, Linn. Hort. Cliff. 482 (1737).
   C. Lane-Poolei, Gardner in Bull. For. Dept. xxxii. 30 (1923).
   C. furfuracea, W. V. Fitzg. in Journ. Roy. Soc. W.A. iii. 108 (1918).
   C. angulata, R.Br. Prodr. 348 (1810) (C. media, Benth.).
   C. basaltica, Gardner in Bull. For. Dept. xxxii. 31 (1923).
2. *MACROZAMIA*, Miq. Monogr. Cycad. 36 (1841).
   M. Reidlei (Gaud.) Gardner. comb. nov. (*M. Fraseri*, Miq.)
   M. Dyeri, (F.v.M.) Gardner. comb. nov. (*Encephalartos Dyeri*, F.v.M.)

CONIFERAE.

Podocarpaceae.

1. *PODOCARPUS*, L' Herit. Pers. Syn. Pl. ii. 580 (1807).
   P. Drouyniana, F. v. M. Fragm. iv. 86. t. 31 (1864).

Cupressaceae.

1. *ACTINOSTROBUS*, Miq. in Lehm. Pl. Preiss. i. 644 (1845).
   A. pyramidalis, Miq. in Lehm. Pl. Preiss. i. 644 (1845).
   A. acuminatus, Parlat. Ind. Sem. Hort. Florent. 25 (1862).
2. *CALLITRIS*, Vent. Decas Gen. Nov. 10 (1808). (*Frenela*, Mirb. p. p.).
   C. Roei, (Endl.) F. v. M. Census 109 (1882).
   C. Drummondii, (Parlat) F. v. M. Census 109 (1882).
   C. Morrisoni, R. T. Baker in Proc. Linn. Soc. N.S.W. xxxi. 717 (1907).
   C. robusta, (R.Br.) Mirb. in Mem. Mus. Par. xiii. 74 (1825).
   C. verrucosa, (R.Br.) Mirb. l. c. 74.
   C. glauca, (R.Br.) Mirb. l. c. 74.
   C. intratropica. (F. v. M.) R. T. Baker, Pines of Australia, 172 (1910).

ANGIOSPERMAE.

MONOCOTYLEDONEAE.

PANDANALES.

Typhaceae.

1. *TYPHA* (Tourn.) Linn. Syst. ed. i. (1735).
   T. angustifolia, Linn. Sp. Pl. 971 (1735).

Pandanaceae.

1. *PANDANUS*, (Rumph.) Linn. fil. Suppl. 64 (1781).
   P. odoratissimus, Linn. fil. Suppl. 424 (1781).
   P. aquaticus, F. v. M. Fragm. v. 40 (1856).

HELIOBIAE.

Potamogetonaceae.

1. *POSIDONIA*, Koenig. Ann. of Bot. ii. 95 (1805).
   P. australis, Hook, fil. Fl. Tasm. ii. 43 (1860).
2. *POTAMOGETON*, (Tourn.) Linn. Syst. ed. i. (1735).
   P. tricarinatus, F. v. M. et A. Benn. in Brit. Journ. Bot. xxx. 229 (1892) (*P. natans*, Bth.).
   P. javonicus, Hassk. in Verhn. Natur. K. Ver. Nedrl. Ind. i. 26 (1856).
   P. Drummondii, Benth. Fl. Austr. vii. 171 (1878).
   P. orchreatus, Raoul Ann. Soc. Nat. Ser. iii. 117 (1844). (*P. obtusifolius*, Mert.).
   P. pectinatus, Linn. Sp. Pl. 127 (1753).
3. *RUPPIA*, Linn. Syst. Nat. 9 (1735).
   R. maritima, Linn. Sp. Pl. 127 (1753).
4. *CYMODOCEA*, Koenig. in Kon. & Sims Ann. Bot. ii. (1806).
   C. angustata, Ostf. in Dansk. Bot. Arkiv. ii. no. 6, 19 (1916).
   C. isoctifolia, Aschers, Sitzber, Geo. Nat. Freunde Berlin 3 (1867).
   C. antarctica, (Labill.) Endl. Gen. Pl. 230 (1836).
5. *DIPLANTHERA*, Thou. Gen. Nov. Madag. 3 (1806).
   D. uninervis, (Forsk.) Aschers in Engl. et Prant. Naturpflanz. 37 (1897).
6. *ALTHENIA*, Petit. in Ann. Soc. Obs. i. (1829). (*Lepilaena*, J. Drumm.)
   A. australis, (Drum.) Aschers. in Engl. et Prantl. Natpflanz. ii. 1. (1887).
   A. Preissii, (Lehm.) Aschers et Graebn. in Engler's Pflanzenreich, Potamog. 160 (1907).

Naiadaceae.

1. *NAIAS*, Linn. Sp. Pl. ed. i. 1015 (1753).
   N. marina, Linn. Sp. Pl. ed. i. 1015 (1753) (*N. maior*, All.).
   N. tenuifolia, R.Br. Prodr. 345 (1810).

Aponogetonaceae.

1. *APONOGETON*, Linn. fil. Suppl. Pl. 32 (1781).
   A. elongatus, (F. v. M.) Benth. Fl. Austr. vii. 188 (1878).

Scheuchzeriaceae.

1. *TRIGLOCHIN*, (Riv.) Linn. Syst. ed. i. (1735).
   T. striata, Ruiz et Pav. Fl. Peruv. iii. 72 (1802).
   T. mucronata, R.Br. Prodr. 343 (1810).
   T. calcitrapa, Hook. Ic. Pl. viii. t. 731 (1845).

T. Stowardi, N. E. Brown in Kew Bull. Misc. 189 (1914).
T. turrifera, Ewart in Vict. Nat. xxiii. 43 (1906).
T. centrocarpa, Hook. Icon. Pl. viii. t. 728 (1845).
T. minutissima, F. v. M. Fragm. vi. 82 (1867).
T. trichophora, Nees et Essenbach in Lehm. Pl. Preiss. ii. 54 (1846).
T. Muelleri, Buchenau in Engl. Pflanzenreich iv. 15, 12 (1903).
T. procera, R.Br. Prodr. 343 (1810).
T. pterocarpa, W. V. Fitzg. in Journ. Roy. Soc. W.A. iii. 110 (1918).

Alismaceae.

1. *ALISMA*, Linn. Gen. ed. I. 108 (1737).
A. oligococcum, F. v. M. Fragm. i. 23 (1858).
2. *DAMASONIUM*, Mill. Gard. Dict. ed. vi. (1752).
D. minor, (R.Br.) Buchenau, Ind. Crit. in Abh. Nat. Ver. Brem, ii. 20, 39 (1868). (*D. australe*, Salisb.)

Hydrocharitaceae.

1. *OTTELIA*, Pers. Syn. Plant. i. 400 (1805).
O. ovalifolia, (R.Br.) L. C. Rich, in Mem. Inst. Fr. ii. 78 (1811).
2. *MAIDENIA*, (W. V. Fitzg.) Rendle, in Journ. Bot. liv. 313 (1916).
M. rubra, (W. V. Fitzg.) Rendle, in Journ. Bot. liv. 313 (1916).
3. *VALLISNERIA*, (Mich.) Linn. Gen. ed. i. 300 (1737).
V. spiralis, Linn. Sp. Pl. 1015 (1753).
4. *HALOPHILA*, Thou. Gen. Nov. Madag. n. 6 (1806).
H. ovalis, (R.Br.) Hook. f. Fl. Tasm. ii. 45 (1860).
H. spinulosa, (R.Br.) Aschers. in Nuemayer. Anleit. Wissan. Beob. 368 (1875).

GLUMIFLORAE.

Gramineae.

1. *CHIONACHNE*, R.Br. in Beauv. Pl. Jav. Rar. 15 (1838).
C. cyathopoda, (F.v.M.) Benth. Fl. Austr. vii. 516 (1878).
2. *DIMERIA*, R.Br. Prodr. Fl. Nov. Holl. 204 (1810).
D. ornithopoda, Trin. Fund. Agrost. 167 (1820). (*D. tenera*, Trin.).
3. *IMPERATA*, Cyrillo, Pl. Rar. Ic. ii. 26. t. 11 (1792).
I. cylindrica, (Linn.) Beauv. Agrost. 165 (1812) (*I. arundinacea*, Cyrillo).
4. *POLLINIA*, Trin. in Mem. Acad. Petersb. ser. vi. ii. 304 (1833).
P. fulva, (R.Br.) Benth. Fl. Austr. vii. 526 (1878).
5. *ROTTBOELLIA*, Linn. fil. Nov. Gram. Gen. in Amoen Acad x. 22 (1779) p.p.
R. rottboellioides, (R.Br.) Druce in Rep. Bot. Exch. Cl. Brit. Isles. 1916, 644 (1917). (*R. ophiuroides*, Benth.)
R. compressa, Linn. f. Suppl. 114 (1781). (*Hemarthria compressa*, R.Br.)
6. *ISCHAEMUM*, Linn. Gen. ed. ii. 525 (1742).
I. nervosum (Rottb.) Gardner n. comb. (*I. laxum*, R.Br.)
7. *ANDROPOGON*, Linn. Sp. Pl. ed. i. 1045 (1753).
A. intermedius, R.Br. Prodr. 202 (1810).
A. Ischaemum, Linn. Sp. Pl. 1047 (1753).
A. sericeus, R.Br. Prodr. 201 (1810).
A. affinis, R.Br. Prodr. 201 (1810).
A. annulatus, Forsk. Fl. Ægypt. Arab. 173 (1775).
A. procerus, R.Br. Prodr. 202 (1810).
A. exaltatus, R.Br. l. c. 202.
A. bombycinus, R.Br. l. c. 202.
A. brevifolius, Swartz. Fl. Ind. occ. i. 209 (1797) (*A. fragilis*, R.Br.).
A. axilis, Hochst. in Flora xxvii. 241 (1844).
A. Gryllus, Linn. Cent. Pl. ii. 33 (1759). (*Chrysopogon Gryllus*, Trin.)
*A. *halepensis* (Linn.) Sibth. et. Sm. Reg. calid.
A. australis, Spreng. Syst. i. 287 (1825). (*Holcus plumosus*, R.Br.)
A. stipoides, (Ewart) Gardner n. comb. (*Sarga stipoidea*, Ewart & White.)
A. intrans. F.v.M. Cens. Austr. Pl. 132 (1882).
8. *HETEROPOGON*, Pers. Syn. Glum. ii. 533 (1807).
H. hirtus, Pers. Syn. Glum. ii. 533 (1807). (*H. contortus*, Roem. et Schultz.)
H. insignis, Thw. Enum, Pl. Ceyl. 437 (*Andropogon triticeus*, R.Br.).

9. *THEMEDA*, Forsk. Fl. Ægypt. Arab. 178 (1775). (*Anthistiria*, Linn. f.)
 T. triandra, Forsk. Fl. Ægypt. Arab. 178 (1775). (*A. imberbis*, Retz. & *A. ciliata*, Benth.)
 T. avenacea, (F.v.M.) Maiden et Betche, Cens. Pl. N.S.W. 15 (1916). (*A. avenacea*. F.v.M.)

10. *ISEILEMA*. Anderss. in Not. Act. Upsal. iii. 2. 250 (1856). (*Anthistiria*, Linn. f.)
 I. membranacea, (Lindl.) Anderss. in Nov. Act. Upsal. iii. 2. 250 (1856). (*A. membranacea*, Ldl.)

11. *TRAGUS*, Hall. Hist. Stirp. Helv. ii. 203 (1768).
 T. racemosus, (Linn.) Hall. Hist. Stirp. Helv. ii. 203 (1768). (*Lappago racemosa*, Willd.)

12. *NEURACHNE*, R.Br. Prodr. Fl. Nov. Holl. 196 (1810).
 N. alopecuroides, R.Br. Prodr. 196 (1810).
 N. Muelleri, Hack in Oest, Bot. Zeit. xlv. 329 (1895).
 N. Mitchelliana, Nees in Hook. Lond. Journ. ii. 410 (1843).
 N. multiculmis, R. Pilger in Engler's Botan. Jahrb. xxxv. 68 (1904).

13. *PEROTIS*, Ait. Hort. Kew ed. I. i. 85 (1789).
 P. rara, R.Br. Prodr. 172 (1810). (*P. latifolia*, Ait.)

14. *ARUNDINELLA*, Raddi. Agrost. Bras. 37. t. 1. (1823).
 A. brasiliensis, Raddi. Agrost. Bras. 37. t. i. Fig. 3 (1823). (*A. nepalensis*, Trin.)

15. *PASPALUM*, Linn. Syst. ed. x. 855 (1759).
 P. scrobiculatum, Linn. Mant. i. 29 (1767).
 P. distichum, Linn. Syst. Nat. ed. x. 855 (1759).

16. *ERIOCHLOA*, Humb. in H.B. et. K. Nov. Gen. et sp. i. 94. t. 30 & 31 (1815).
 E. punctata, (Linn.) Hamilt. Prodr. Pl. Ind. occ. 5 (?).

17. *ISACHNE*, R.Br. Prodr. Fl. Nov. Holl. 196 (1810).
 I. australis, R.Br. Prodr. 196 (1810).

18. *DIGITARIA*, Hall. Hist. Stirp. ii. 244 (1768). (*Panicum*, Benth. p.p.)
 D. ctenantha, (F.v.M.) Hughes, Kew Bull. Misc. 310 (1923). (*P. ctenanthum*, F.v.M.)
 D. longiflora, (Retz.) Pers. Syn. i. 85 (1805). (*Paspalum longiflorum*. Retz.)
 D. marginata, Link. Hort. Berol. i. 229 (1827). (*Panicum sanguinale*, Benth. p.p.)
 D. sanguinalis (Linn.) Scop. Fl. Carn. ed. ii. i. 52 (1772). (*P. sanguinalis*, Linn. p.p.)
 D. Brownii, (Roem et Schultz) Hughes, Kew Bull. Misc. 313 (1923). (*P. leucophleum*. Benth.)
 D. ammophila, (F.v.M.) Hughes, l. c. 313. (*P. divaricatissimum*, var.)
 D. coenicola, (F.v.M.) Hughes, l. c. 313. (*P. coenicolum*, F.v.M.)

19. *BRACHIARIA*. Griseb in Ledeb. Fl. Ross. iv. 469 (1853).
 B. holsericea, (R.Br.) Hughes, in Kew Bull. Misc. 315 (1923). (*P. holsericeum*, R.Br.)
 B. piligera, (F.v.M.) Hughes, l. c. 315.
 B. distachya (Linn.) A. Camus. Fl. Indo-China vii. 437 (1922). (*P. distachyum*, Linn.)

20. *PASPALIDIUM*, Stapf. in Prain. Fl. Trop. Afr. ix. 582 (1920).
 P. jubiflorum, (Trin.) Hughes, Kew Bull. Misc. 317 (1923). (*P. flavidum & P. gracile*, p.p.)
 P. basicladum, Hughes, l. c. 318.
 P. gracile, (R.Br.) Hughes, l. c. 318. (*Panicum gracile*, R.Br.)
 ECHINOCHLOA, Beauv. Agrost. 53. ii. f. 2 (1812).
 **E. colona*, (Linn.) Link. Reg. calid. (*Panicum colonum*, Linn.)
 **E. Crus-Galli*, (Linn.) Beauv. Reg. calid. (*P. Crus-Galli*, Linn.)

21. *PARACTAENUM*, Beauv. Agrost. 47. t. x. f. 6 (1812).
 P. Novae-Hollandiae, Beauv. Agrost. 47. t. x. f. 6 (1812). (*Panicum reversum*, F.v.M.)

22. *PANICUM*, Linn. Sp. Pl. 55 (1753).
P. cymbiforme, Hughes, in Kew Bull. Misc. 323 (1923). (*P. antidotale*, Benth. p.p.)
P. capillipes, Benth. Fl. Austr. vii. 484 (1878).
P. Queenslandicum, Domin in Fedde. Repert. x. 59 (1911).
P. decompositum, R.Br. Prodr. 191 (1810).
P. effusum, R.Br. Prodr. 191 (1810).

23. *ICHNANTHUS*, Beauv. Agrost. 56. t. xii. f. 1 (1812).
I. australiensis, (Domin) Hughes, Kew Bull. Misc. 329 (1923). (*P. australiense*, Domin.)
I. Muelleri, Hughes, l. c. 329.

24. *SACCIOLEPIS*, Nash. in Britton. Man. Bot. 89 (1901).
S. myosuroides, (R.Br.) Hughes in Kew Bull. Misc. 330 (1923). (*P. myosuroides*, R.Br.)

25. *SETARIA*, Beauv. Fl. Owar. ii. 80 (1807). (*Chaetochloa*, Scribn. (1897).)
S. glauca, (Linn.) Beauv. Agrost. 51 (1812).
S. verticillata, (Linn.) Beauv. l. c. 51.
S. viridis, (Linn.) Beauv. l. c. 51.
S. Buchanani, A. S. Hitchc. in Proc. Linn. Soc. N.S.W. lii. (ii.) 185 (1927).
S. Carnei, H. S. Hitchc. l. c. 185.
S. macrostachya, H.B. et K. Nov. Gen. et Sp. i. 110 (1815).

26. *CENCHRUS*, Linn. Coroll. Gen. 20 (1737).
*C. *tribuloides*, Linn. Am. bor.
C. elymoides, F.v.M. Fragm. viii. 107 (1874).

27. *PSEUDOCHAETOCHLOA*, A. S. Hitchc. in Journ. Washgtn. Acad. Sci. xiv. 21. 492 (1924).
P. australiensis, A. S. Hitchc. in Journ. Washgtn. Acad. Sci. xiv. 21. 492 (1924).

28. *PENNISETUM*, Rich. in Pers. Syn. i. 72 (1805).
P. villosum, R.Br. in Salt. Abyss. App. 62 (1818).
P. Basedowii, Summerhayes & Hubbard, Kew. Bull. Misc. 440 (1926).
P. cenchroides, Rich. in Pers. Syn. i. 72 (1805).
P. arnhemicum, F. v. M. Fragm. viii. 109 (1873).

29. *PLAGIOSETUM*, Benth. in Hook. Ic. Pl. xiii. 33 (1877).
P. refractum, (F.v.M.) Benth. in Hook. Ic. Pl. t. 1242 (1877).

30. *CHAMAERAPHIS*, R.Br. Prodr. Fl. Nov. Holl. 193 (1810).
C. spinescens, (R.Br.) Poir. Encycl. Suppl. ii. 189 (1817).

31. *XEROCHLOA*, R.Br. Prodr. Fl. Nov. Holl. 196 (1810).
X. imberbis, R.Br. Prodr. 197 (1810).
X. barbata, R.Br. l. c. 197.
X. laniflora, (F. v. M.) Benth. Fl. Austr. vii. 502 (1878).
STENOTAPHRUM, Trin. Fund. Agrost. 175 (1820).
**S. dimidiatum*, (Linn.) Brongn. (Trop. et. Sub. Trop. Reg.).

32. *SPINIFEX*, Linn. Mant. ii. 163 (1771).
S. hirsutus, Labill. Nov. Holl. Pl. ii. 81. t. 230 (1806).
S. longifolius, R.Br. Prodr. 198 (1810).

33. *ORYZA*, Linn. Syst. ed. I. (1735).
O. sativa, Linn. Sp. Pl. 333 (1753).
EHRHARTA, Thunb. in Vet. Acad. Handl. Stockh. 216 t. 8 (1779).
**E. longiflora*, Sm. (Africa aust.).
**E. brevifolia*, Schrad. (Africa aust.).
**E. calycina*, Sm. (Africa aust.).

34. *MICROLAENA*, R.Br. Prodr. Fl. Nov. Holl. 210 (1810).
M. stipoides, (Labill) R.Br. Prodr. 210 (1810).

35. *TETRARRHENA*, R.Br. Prodr. Fl. Nov. Holl. 209 (1810).
T. laevis, R.Br. Prodr. 210 (1810).
PHALARIS, Linn. Syst. ed. I. (1735).
**P. minor*, Retz. Reg. Medit.
**P. canariensis*. Linn. Reg. Medit.
ANTHOXANTHUM, Linn. Gen. ed. I. 18 (1837).
**A. odoratum*, Linn. Europ. As. bor. Afr. bor.

36. *AMPHIPOGON*, R.Br. Prodr. Fl. Nov. Holl. 175 (1810).
A. debilis, R.Br. Prodr. 175 (1810).
A. strictus, R.Br. l. c. 175.
A. laguroides, R.Br. l. c. 175.
A. cygnorum, Nees in Lehm. Pl. Preiss. ii. 100 (1846).
A. turbinatus, R.Br. Prodr. 175 (1810).
A. restionaceus, R. Pilger, in Engler's Botan. Jahrb. xxxv. 72 (1904).

37. *ARISTIDA*, Linn. Sp. Pl. I. 82 (1753).
A. hygrometrica, R.Br. Prodr. 174 (1810).
A. stipoides, R.Br. l. c. 174.
A. Browniana, Henr.
A. arenaria, Gaud. in Freyc. Voy. Bot. 407 (1826).
A. calycina, R.Br. Prodr. 173 (1810).

38. *STIPA*, Linn. Sp. Pl. ed. II. 78 (1753).
S. elegantissima, Labill. Nov. Holl. Pl. i. 24 t. 29 (1804).
S. juncifolia, Hughes, in Kew Bull. Misc. 11 (1921).
S. eriopus, Benth. Fl. Austr. vii. 570 (1878).
S. tenuifolia, Steud. Syn. Glum. i. 128 (1855).
S. leptophylla, Hughes, in Kew Bull. Misc. 14 (1921).
S. trichophylla, Benth. Fl. Austr. vii. 570 (1878).
S. falcata, Hughes, in Kew Bull. Misc. 14 (1921).
S. arachnopus, Pilg. in Engler's Botan. Jahrb. xxxv. 70 (1904).
S. variabilis, Hughes, in Kew Bull. Misc. 15 (1921).
S. Drummondii, Steud. Syn. Glum. i. 128 (1855).
S. incurva, Hughes, in Kew Bull. Misc. 16 (1926).
S. platychaeta, Hughes, in l. c. 16 (1926).
S. scabra, Lindl. in Mitch. Trop. Austr. 31 (1848).
S. pycnostachya, Benth. Fl. Aust. vii. 568 (1878).
S. hemipogon, Benth. l. c. 569.
S. nobilis, Pilg. in Engler's Botan. Jahrb. xxxv. 70 (1904).
S. semibarbata, R.Br. Prodr. 174 (1810).
S. eremophila, Reader, in Vict. Nat. xvii. 154 (1901).
S. hirsuta, Hughes, in Kew Bull. Misc. 22 (1921).
S. tenuiglumis, Hughes, l. c. 22.
S. elatior, Hughes, l. c. 24.
S. puberula, Steud. Syn. Glum. i. 128 (1848).
S. crinita, Gaud. in Freyc. Voy. Bot. 407 (1826).
S. compressa, R.Br. Prodr. 174 (1810).
S. Mc Alpinei, Reader, in Vict. Nat. xv. 143 (1899).
ORYZOPSIS, Mich. Fl. Bor. Am. i. 51. t. 9 (1803).
**O. miliacea*, (Linn.) Aschers. et Schweinf. (Reg. Medit.)

39. *ECHINOPOGON*, Beauv. Agrost. 42 t. 9. f. 5 (1812).
E. ovatus, (Forst.) Beauv. Agrost. 42. t. 9. f. 5 (1812).
PHLEUM, Linn. Syst. ed. I. (1735).
**P. pratense*, Linn. (Reg. bor. temp.)

40. *ALOPECURUS*, Linn. Syst. ed. i. (1735).
A. geniculatus, Linn. Sp. Pl. 60 (1753).

41. *SPOROBOLUS*, R.Br. Prodr. Fl. Nov. Holl. 169 (1810).
S. virginicus, (Linn.) Kunth. Rev. Gram. i. 68 (1832).
S. indicus, R.Br. Prodr. 170 (1810).
S. pulchellus, R.Br. l. c. 170.
S. Lindleyi, (Steud.) Benth. Fl. Austr. vii. 623 (1878).
S. actinocladus, F.v.M. Fragm. viii. 140 (1874).

42. *POLYPOGON*, Desf. Fl. Atlant. i., 66 (1798).
P. monspeliensis, Desf. Fl. Atlant. i. 66 (1798).
P. fugax, Nees in Steud. Syn. Glum. i. 184 (1855).
P. tenellus, R.Br. Prodr. 173 (1810).
AGROSTIS, Linn. Syst. ed. I. (1735).
**A. alba*, Linn. (Europ.)
**A. venusta*, Trin. (Reg. Medit.)

43. *CALAMAGROSTIS*, Adans. Fam. ii. 31 (1763).
C. aemula, Steud. Nom. ed. ii. i. 249 (1821). (*Deyeuxia Forsteri*, Kunth.)
C. quadriseta, (Labill.) Spreng. Syst. i. 253 (1825). (*Deyeuxia cylindrica*, R.Br.)

44. *DICHELACHNE*, Endl. Prodr. Fl. Norf. 20 (1838).
D. crinita, (Linn. f.) Hook. f. Fl. New Zeal. i. 293 (1853).
D. sciurea, (R.Br.) Hook. f. l. c. 294.
AMMOPHILA, Host Gram. Austr. iv. t. 41 (1809).
**A. arenaria*, (Linn.) Link. (Europ: Amer. bor.).

45. *DIPLOPOGON*, R.Br. Prodr. Fl. Nov. Holl. 176 (1810).
D. setaceus, R.Br. Prodr. 176 (1810).

46. *PENTAPOGON*, R.Br. Prodr. Fl. Nov. Holl. 173 (1810).
P. quadrifidus, (Labill.) Baill. Hist. des pl. xii. 280 (1894). (*P. Billardieri*, R.Br.)
LAGURUS, Linn. Gen. ed. i. 353 (1737).
**L. ovatus*, Linn. (Europ.).

47. *ERIACHNE*, R.Br. Prodr. Fl. Nov. Holl. 183 (1810).
E. squarrosa, R.Br. Prodr. 183 (1810).
E. pauciflora, W. V. Fitzg. in Journ. Roy. Soc. W.A. iii. 115 (1918).
E. glauca, R.Br. Prodr. 183 (1810).
E. ciliata, R.Br. l. c. 184.
E. aristidêa, F.v.M. Fragm. v. 205 (1866).
E. festucacea, F.v.M. l. c. 205.
E. ovata, Nees in Hook. Lond. Journ. Bot. ii. 416 (1843).
E. meliacea, F.v.M. Fragm. v. 205 (1866).
E. nana, Pilg. in Engler's Botan. Jahrb. xxxv. 75 (1904).
E. pallida, (F.v.M.) Benth. Fl. Austr. vii. 631 (1878).
E. scleranthoides, F.v.M. Fragm. viii. 233 (1874).
E. inermis, Pilger, in Engler's Botan. Jahrb. xxxv. 75 (1904).
E. obtusa, R.Br. Prodr. 184 (1810).
AIRA, Linn. Fl. Lapp. 27 (1737).
**A. caryophyllea*, Linn. (Europ. Oriens.).
**A minuta*, Linn. (Europ. Oriens.).

48. *DESCHAMPSIA*, Beauv. Agrost. 91. t. 8 (1812).
D. caespitosa, (Linn.) Beauv. Agrost. 91. t. 8 (1812).
AVENA, Linn. Syst. ed. i. (1735).
**A. fatua*, Linn. (Europ. Oriens. As. bor.).
**A. barbata*, Brotero. (Reg. Mediterr. As. Min, Arab.).
HOLCUS, Linn. Syst. ed. i. (1735).
**H. lanatus*, Linn. (Europ.).

49. *AMPHIBROMUS*, Nees in Hook. Lond. Journ. ii. 420 (1843).
A. nervosus, (R.Br.) Hook. f. Fl. Tasm. ii. pl. clxiii. (1860).

50. *DANTHONIA*, D. C. Fl. Franc. iii. 32 (1805).
D. bipartita, F.v.M. Fragm. i. 160 (1859).
D. penicillata, (Labill) F.v.M. Fragm. viii. 135 (1873).
PENTASCHISTIS, Stapf. in Dyer Fl. Cap. vii. 480 (1899).
**P. Thunbergii*, (Kunth.) Stapf. (Afr. aust.).

51. *PAPPOPHORUM*, Schreb. Gen. Pl. ii. 787 (1791).
P. nigricans, R.Br. Prodr. 185 (1810).

52. *TRIRAPHIS*, R.Br. Prodr. Fl. Nov. Holl. 185 (1810).
T. mollis, R.Br. Prodr. 185 (1810).
T. pungens, R.Br. l. c. 185.
T. bromoides, F.v.M. Fragm. viii. 108 (1874).
T. rigidissima, Pilger in Engler's Jahrb. xxxv. 72 (1904).
T. danthonioides, F.v.M. Fragm. viii. 125 (1874).

53. *ELYTROPHORUS*, Beauv. Agrost. 67 (1812).
E. articulatus, Beauv. Agrost. 67 (1812).

54. *TRIODIA*, R.Br. Prodr. Fl. Nov. Holl. 182 (1810).
T. Mitchelli, Benth. Fl. Austr. vii. 606 (1878).
T. pungens, R.Br. Prodr. 182 (1810).
T. Cunninghamii, Benth. Fl. Austr. vii. 606 (1878).
T. irritans, R.Br. Prodr. 182 (1810).
T. procera, R.Br. l. c. 182.
T. microstachya, R.Br. l. c. 182.

55. *DIPLACHNE*, Beauv. Agrost. 9 (1812).
D. loliiformis, (F.v.M.) Benth. Fl. Austr. vii. 618 (1878).
D. fusca, (Linn.) Beauv. Agrost. 163 (1812).
D. parviflora, (R.Br.) Benth. Fl. Austr. vii. 620 (1878).

56. *PHRAGMITES,* Trin. Fund. Agrost. 134 (1820).
P. vulgaris, (Lam.) Druce, List. Brit. Pl. 81 (1908). (*P. phragmites* (Linn.) Karst); (*P. communis,* Trin.)
LAMARCKIA, Moench. Meth. 201 (1794).
**L. aurea,* (Linn.) Moench. (Reg. Mediterr.)
CYNOSURUS, Linn. Gen. ed. i. 13 (1737).
**C. echinatus,* Linn. (Reg. Mediterr.)
KOELERIA, Pers. Syn. Glum. i. 97 (1805).
**K. phleoides,* Pers. (Reg. Mediterr.)
AVELLINIA, Parlàt. Pl. Nov. 59 (1842).
**A. Michelii* (Savi.) Parlàt. (Italia.)
TRISETUM, Pers. Syn. Glum. i. 97 (1805).
**T pumilum,* Kunth. (Af. austr.).
BRIZA, Linn. Syst. ed. I. (1735).
**B. maxima,* Linn. (Reg. Mediterr.; Af. austr.)
**B. minor,* Linn. (Europ. Oriens; As. bor.)
DACTYLIS, Linn. Gen. ed. II. 29 (1742).
**D. glomerata,* Linn. (Europ.; As. bor.)

57. *ERAGROSTIS,* Beauv. Agrost. 70 (1812).
E. tenella, (Linn.) Roem et Schultz. Syst. Veg. ii. 576 (1817).
E. leptocarpa, Benth. Fl. Austr. vii. 644 (1878).
E. pilosa, (Linn.) Beauv. Agrost. 71 (1812).
E. trichophylla, Benth. Fl. Austr. vii. 644 (1878).
E. diandra, Steud. Synops. Pl. Glum. i. 279 (1855).
E. Brownii, Nees in Steud. Nomencl. Bot. i. 562 (1841).
E. speciosa, Steud. in Synops. Pl. Glum. i. 279 (1855).
E. eriopoda, Benth. Fl. Austr. vii. 648 (1878).
E. setifolia, Nees in Hook. Lond. Journ. ii. 419 (1843).
E. falcata, Gaud. in Freyc. Voy. Bot. 408. t. 25 (1826).
E. Dielsii, Pilger, in Engler's Botan. Jahrb. xxxv. 76 (1904).

58. *ECTROSIA,* R.Br. Prodr. Fl. Nov. Holl. 185 (1810).
E. Schultzii, Benth. Fl. Austr. vii. 633 (1878).
E. leporina, R.Br. Prodr. 186 (1810).
SCHISMUS, Beauv. Agrost. 73. t. 15. f. 4 (1812).
**S. calycinus,* (Linn.) Coss. et Dur. (Reg. Mediterr; Afr. austr.).

59. *POA,* Linn. Gen. Pl. 20 (1737).
P. caespitosa, Forst. Prodr. 89 (1786).
P. Maxwelli, Benth. Fl. Austr. vii. 653 (1878).
P. Drummondiana, Nees in Hook. Lond. Journ. Bot. ii. 418 (1843). (*P. nodosa,* Nees.)
**P. bulbosa,* Linn. (Europ.)
**P. annua,* Linn. (Cosmop.)

60. *GLYCERIA,* R.Br. Prodr. Fl. Nov. Holl. 179 (1810).
G. fluitans, (Linn.) R.Br. Prodr. 179 (1810).
G. stricta, Hook. fil. Fl. Nov. Zeal. i. 304 (1855).
G. ramigera, F.v.M. Fragm. viii. 131 (1874).
G. australasica, Steud. Syn. Glum. i. 286 (1855).

61. *FESTUCA,* Linn. Syst. ed. i. (1735).
F. scirpoidea, F.v.M. Fragm. viii. 129 (1874). (*Schedonorus scirpoideus,* Benth.)
F. littoralis, Labill. Nov. Holl. Pl. i. 22. t. 27 (1804). (*S. littoralis,* Beauv.)
**F. elatior,* Linn. (Europ.; As. bor.)
**F. Myuros,* Linn. (Europ.; Am. et As. bor.).
**F. bromoides,* Linn. (Reg. temp.)
**F. rigida,* (Linn.) Kunth. (Europ. Austr.; Afr. bor.)

62. *BROMUS,* Linn. Syst. Nat. 8 (1735).
**B. maximus,* Desf. (Europ.; Reg. Mediterr. et Caucas.)
**B. Madritensis,* Linn. (Europ.; Afr. bor.; Oriens.)
**B. unioloides,* H.B. et K. (Am. calid.)
B. arenarius, Labill. Nov. Holl. Pl. i. 23. t. 28 (1804).
**B. mollis,* Linn. (Europ.; Afr. et As. bor.)
BRACHYPODIUM. Beauv. Agrost. 100 (1812).
**B. distachyum,* Roem et Schultz. (Reg. Mediterr.; Oriens.)

63. *CYNODON.* Rich. in Pers. Syn. Glum. i. 85 (1805).
C. Dactylon, Rich. in Pers. Syn. Glum. i. 85 (1805).
C. tenellus, R.Br. Prodr. 187 (1810).
C. convergens, F.v.M. Fragm. viii. 113 (1874).

64. *CHLORIS*, Swartz. Nov. Gen. et Sp. Plant. 25 (1788).
C. pectinata, Benth. Fl. Austr. vii. 612 (1878).
C. divaricata, R.Br. Prodr. 186 (1810).
C. acicularis, Lindl. in Mitch. Trop. Austr. 33 (1848).
C. truncata, R.Br. Prodr. 186 (1810).
C. barbata, Swartz. Nov. Gen. et Sp. Pl. 25 (1788).
C. scariosa, F.v.M. Fragm. vi. 85 (1868).
C. pallida, Hack. in Engler's Botan. Jahrb. vi. 244 (1885).
65. *ASTREBLA*, (F.v.M.) Benth. Flora Australiensis, vii. 602 (1878).
A. pectinata, (Lindl.) Benth. Fl. Austr. vii. 602 (1878).
A. elymoides, Bail et F.v.M. Illustr. Queensland Grasses (1878).
A. triticoides, (Lindl.) Benth. Fl. Austr. vii. 602 (1878).
66. *DACTYLOCTENIUM*, Willd. Enum. Hort. Berol. 1029 (1809).
D. australiense, Scribn. (*D. aegyptium*, (L.) Willd.)
67. *ELEUSINE*, Gaertn. Fruct. i. 7 (1788).
E. racemosa, Heyne, in Roth. Nov. Sp. Pl. 80 (1817). (*E. verticillata*, Roxb.)
68. *LEPTOCLOA*, Beauv. Agrost. 71. t. 15 (1812).
L. digitata, (R.Br.) Domin, in Biblioth Bot. lxxxv. 379 (1915). (*L. subdigitata*, Trin.)
LOLIUM, Linn. Syst. ed. I. (1735).
**L. temulentum*, Linn. (Europ.; As. bor.).
**L. perenne*, Linn. (Europ.; As. temp.).
**L. rigidum*, Gaud. (Europ.).
69. *LEPTURUS*, R.Br. Prodr. Fl. Nov. Holl. 207 (1810).
L. cylindricus, Trin. Fund. Agrost. 123 (1820).
70. *AGROPYRON*, Gaertn. in Nov. Comm. Petrop. xiv. I. 539 (1770), (*Agropyrum*, (Beauv).)
A. scabrum, (Labill.) Beauv. Agrost. 102 (1812).
**A. repens*, (Linn.) Beauv. (Reg. temp.).
HORDEUM, (Tourn.) Linn. Syst. ed. I. (1735).
**H. murinum*, Linn. (Europ.; Afr. bor.; Oriens.).
**H. maritimum*, With. (Europ. Afr. bor.; Oriens.).

Cyperaceae.

1. *LIPOCARPHA*, R.Br. in Tuckey's Narrative of an Exped. to Congo 459 (1818).
L. microcephala, (R.Br.) Kunth. Enum. ii. 268 (1837).
2. *CARPHA*, Banks et Soland. in R.Br. Prodr. Fl. Nov. Holl. 230 (1810).
C. gracilipes, C. B. Clarke, in Engler's Botan. Jahrb. xxxv. 81 (1904).
3. *CYPERUS*, (Mich.) Linn. Syst. ed. I. (1735).
Subgenus i. Pycreus.
C. flavescens, Linn. Sp. Pl. 46 (1753). (*Pycreus flavescens*, (Linn.) Nees.)
C. polystachyus, Rottb. descr. et Incon. pl. 39 (1773). (*P. polystachyus* (R.Br.) Beauv.)
C. Hochstetteri, Nees, in Regensb. Fl. 755 (1845). (*P. albomarginatus*, Nees.)
Subgenus ii. Juncellus.
C. pygmaeus, Rottb. descr. et Icon. pl. 20 (1773). (*Juncellus pygmaeus*, (Rottb.) Clarke.)
C. laevigatus, Linn. Mant. 179 (1771). (*J. laevigatus*, (Linn.) C. B Clarke.)
Subgenus iii. Eucyperus.
C. trinervis, R.Br. Prodr. 213 (1810).
C. tenellus, Linn. f. Suppl. 103 (1781).
C. difformis, Linn. Amoen. Acad. iv. 302 (1759).
C. Haspan, Linn. Sp. Pl. 45 (1753).
C. leucocephalus, Retz. observ. v. 11 (1788).
C. vaginatus, R.Br. Prodr. 213 (1810).
C. Iria, Linn. Sp. Pl. 45 (1753).
C. aristatus, Rottb. Descr. et Ic. Pl. 23. t. 6. f. i. (1773) (*C. squarrosus*, Benth.)
C. distans, Linn. fil. Suppl 103 (1781).
C. subulatus, R.Br. Prodr. 217 (1810).
C. sporobolus, R.Br. l. c. 215.
C. stenostachyus, Benth. Fl. Austr. vii. 280 (1878).
C. rotundus, Linn. Sp. Pl. 45 (1753).

Subgenus iv. Mariscus.
C. pennatus, Lam. Illustr. Gen. i. 144 (1799). (*Mariscus albescens*, Gaud.)
C. conicus, (R.Br.) Boeckl. in Schlecht. Linnaea. xxxviii. 371 (1874). (*M. cornicus*, R.Br.)
C. alterniflorus, R.Br. Prodr. 216 (1810). (*M. alterniflorus*, C. B. Clarke.)
C. lucidus, R.Br. l. c. 218. (*M. lucidus*, C. B. Clarke.)
C. Cunninghamii, (C. B. Clarke) Gardner, n. comb. (*M. Cunninghamii*, C. B. Clarke.)
C. fulvus, R.Br. Prodr. 215 (1810). (*M. fulvus*, C. B. Clarke.)
C. Holoschoenus, R.Br. Prodr. 215 (1810). (*M. Holoschoenus*, C. B. Clarke.)
C. carinatus, R.Br. l. c. 216. (*M. carinatus*, C. B. Clarke.)

4. *FUIRENA*, Rottb. Descr. et Icon. 70 (1773).
F. glomerata, Lam. Illustr. Gen. i. 150 (1791).
F. umbellata, Rottb. Descr. et Icon. Pl. 70. t. 19. f. 3 (1773).

5. *SCIRPUS*, Linn. Syst. ed. I. (1735).
S. fluitans, Linn. Sp Pl. 48 (1753).
S. cernuus, Vahl. Enum. ii. 245 (1806). (*S. riparius*, Benth.)
S. Isdellensis, W. V. Fitzg. in Journ. Roy. Soc. W.A. iii. 123 (1918).
S. antarcticus, Linn. Mant. ii. 181 (1771). (*S. cartilagineus*, Poir.)
S. arenarius, Benth. Fl. Austr. vii. 325 (1878).
S. multicaulis, (F.v.M.) C. B. Clarke, Kew Bull. Misc. Add. ser. vii. 25 (1908).
S. setaceus, Linn. Sp. Pl. 49 (1753).
S. nodosus, Rottb. descr. et Icon. Pl. 52. t. 8 (1773).
S. supinus, Linn. Sp. Pl. 49 (1753).
S. erectus, Poir. Encycl. vi. 761.
S. articulatus, Linn. Sp. Pl. 47 (1753).
S. mucronatus, Linn. l. c. 50.
S. americanus, Pers. Syn. Pl. i. 68 (1805).
S. lacustris, Linn. Sp. Pl. 51 (1753).
S. maritimus, Linn. l. c. 51.
S. littoralis, Schrad. Fl. Germ. i. 142 (1806).
S. Kochii, Maiden et Betche, in Proc. Linn. Soc. N.S.W. xxxiii. 318 (1908).

6. *CROSSLANDIA*, W. V. Fitzgerald, in Journ. Roy. Soc. W.A. iii. 122 (1918).
C. setifolia, W. V. Fitzg. in Journ. Roy. Soc. W.A. iii. 122 (1918).

7. *ELEOCHARIS*, R.Br. Prodr. Fl. Nov. Holl. 224 (1810).
E. compacta, R.Br. Prodr. 224 (1810).
E. atropurpurea, Kunth. Enum. ii. 151 (1837).
E. Dietrichiana, (Boeckel) C. B. Clarke, Kew Bull. Add. ser. viii. 105 (1908).
E. gracilis, R.Br. Prodr. 224 (1810).
E. acuta, R. Br. Prodr. 224 (1810).

8. *FIMBRISTYLIS*, Vahl. Enum. ii. 285 (1806).
F. tetragona, R.Br. Prodr. 226 (1810).
F. pilifera, W. V. Fitzg. in Journ. Roy. Soc. W.A. iii. 118 (1918).
F. pterygosperma, R.Br. Prodr. 226 (1810).
F. pauciflora, R.Br. l. c. 225.
F. semilevis, (F.v.M.) C. B. Clarke. Kew. Bull. Misc. Add ser. viii. 24 (1908).
F. cardiocarpa, F.v.M. Fragm. i. 194 (1859).
F. denudata, R.Br. Prodr. 227 (1810).
F. caespitosa, R.Br. l. c. 228.
F. diphylla Vahl. Enum. ii. 289 (1806).
F. aestivalis, Vahl. l. c. ii. 289.
F. ferruginea, Vahl. l. c. ii. 291.
F. subaristata, Benth. Fl. Austr. vii. 314 (1878).
F. solidifolia, F.v.M. Fragm. i. 198 (1859).
F. miliacea, Vahl. Enum. ii. 287 (1806).
F. quinquangularis, Kunth. Enum. ii. 229 (1837).
F. rara, R.Br. Prodr. 227 (1810).
F. capitata, R.Br. l. c. 228.
F. Schultzii, Boeckl. in Linnaea xxxviii. 391 (1874).
F. oligocephala, W. V. Fitzg. in Journ. Roy. Soc. W.A. iii. 121 (1918).

F. barbata, (Rottb.) Benth. Fl. Austr. vii. 321 (1878).
F. capillaris, (Linn.) A. Gray Man. of Bot. N.U.S. ed. 5. 567 (1867).
F. arthrostyloides, W. V. Fitzg. in Journ. Roy. Soc. W.A. iii. 121 (1918).

9. *SCHOENUS*, Linn. Corroll. Gen. 2 (1737).
S. cruentus, (Nees) Benth. Fl. Austr. vii. 357 (1878).
S. Benthami, F.v.M. Syst. Cens. Austr. pl. 127 (1882). (*S. compressus*, Benth.)
S. lanatus, Labill. Nov. Holl. Pl. Sp. i. 19. t. 20 (1806).
S. flavus, (Nees) Boeckl. in Linnaea xxxviii. 278 (1874).
S. barbatus, Boeckl. in l. c. 277.
S. curvifolius, (R.Br.) Benth. Fl. Austr. vii. 358 (1878).
S. capitatus, (Nees) F.v.M. Fragm. ix. 58 (1875). (*S. subbulbosus*, Benth.)
S. aphyllus, Boeckl. in Linnaea xxxviii. 279 (1874).
S. sesquispiculus, C. B. Clarke Kew Bull, Misc. Add. Ser. viii. 43 (1908).
S. Drummondii, (Steud.) Benth. Fl. Austr. vii. 359 (1878). (*S. microstachyus*, Nees).
S. nitens, (R.Br.) Poir. Encycl. Suppl. ii. 251 (1811).
S. cygneus, Nees in Lehm. Pl. Preiss. ii. 81 (1846).
S. unispiculatus, (F.v.M.) Benth. Fl. Austr. vii. 365 (1878).
S. breviculmis, Benth. Fl. Austr. vii. 364 (1878).
S. pleiostomoneus, F.v.M. Fragm. ix. 52 (1875).
S. trachycarpus, F.v.M. l. c. 33.
S. nanus, (Nees) Benth. Fl. Austr. vii. 364 (1878).
S. Rodwayanus, W. V. Fitzg. in Proc. Linn. Soc. N.S.W. xxvii. 243 (1903).
S. minutulus, F.v.M. Fragm. ix. 32 (1875).
S. obtusifolius, (Nees) Boeckel, in Linnaea xxxviii. 281 (1874).
S. grammatophyllus, F.v.M. Fragm. ix. 31 (1875)
S. asperocarpus, F.v.M. l. c. 29.
S. grandiflorus, (Nees) F.v.M. l. c. 30.
S. calostachyus, (R.Br.) Poir. Encyc. Meth. Suppl. ii. 251 (1811).
S. efoliatus, F.v.M. Fragm. ix. 32 (1875).
S. multiglumis, Benth. Fl. Austr. vii. 368 (1878).
S. acuminatus, R.Br. Prodr. 231 (1810).
S. falcatus, R.Br. l. c. 232.
S. laevigatus, W. V. Fitzg. in Proc. Linn. Soc. N.S.W. xxviii. 111 (1904).
S. caespititius, W. V. Fitzg. l. c. 110.
S. punctatus, R.Br. Prodr. 232 (1810).
S. bifidus (Nees) Boeckl. in Linneae xxxviii. 282 (1874).
S. laxus, W. V. Fitzg. in Proc. Linn. Soc. N.S. Wales xxviii. 111 (1904).
S. Jamisonianus, W. V. Fitzg. l. c. xxvii. 245 (1903).
S. brevifolius, R.Br. Prodr. 231 (1810).
S. pedicellatus, (R.Br.) Benth. Fl. Austr. vii. 369 (1878).
S. fascicularis, Nees in Ann. Nat. Hist. ser. i. vi. 48 (1842).
S. indutus, (F.v.M.) Benth. Fl. Austr. vii. 372 (1878).
S. odontocarpus, F.v.M. Fragm. ix. 32 (1875).
S. sculptus, (Nees) Boeckl. in Linnaea xxxviii. 286 (1874).
S. humilis, Benth. Fl. Austr. vii. 374 (1878).
S. axillaris, (R.Br.) Poir. Encycl. Suppl. ii. 251 (1811).
S. natans, (F.v.M.) Benth. Fl. Austra. vii. 375 (1878).

10. *GYMNOSCHOENUS*, Nees in Ann. Hist. Ser i. vi. 47 (1841).
G. anceps, (R.Br.) C. B. Clarke, Kew Bull. Add. Ser. viii. 92 (1908).

11. *MESOMELAENA*, Nees in Lehm. Pl. Preiss. ii. 88 (1846).
M. stygia, (R.Br.) Nees in Lehm. Pl. Preiss. ii. 89 (1846).
M. Preissii, Nees in l. c. 88.
M. uncinata (Nees) C. B. Clarke in Kew Bull. Add. ser. viii. 48 (1908).
M. tetragona, (R.Br.) F.v.M. Fragm. ix. 36 (1875).

12. *LEPIDOSPERMA*, Labill. Nov. Holl. Pl. i. 14 (1804).
L. gladiatum, Labill. Nov. Holl. Pl. i. 15. t. 12 (1804).
L. effusum, Benth. Fl. Austr. vii. 387 (1878).
L. rupestre, Benth. l. c. 388.
L. tetraquetrum, Nees in Lehm. Pl. Preiss. ii. 90 (1846).
L. longitudinale, Labill. Nov. Holl. Pl. i. 16. t. 13 (1804).
L. exaltatum, R.Br. Prodr. 234 (1810).
L. angustatum, R.Br. l. c. 235.
P. resinosum (Nees) Benth. Fl. Austr. vii. 392 (1878).

L. viscidum, R.Br. Prodr. 234 (1810).
L. Drummondii, Benth. Fl. Austr. vii. 391 (1878).
L. tuberculatum, Nees in Lehm. Pl. Preiss. ii. 90 (1846).
L. Brunonianum, Nees. l. c. 92.
L. costale, Nees. l. c. 92.
L. aphyllum, R.Br. Prodr. 235 (1810).
L. Benthamianum, C. B. Clarke, Kew Bull. Add. ser. viii. 91 (1908).
L. pubisquameum, Steud. Syn. Glum. ii. 158 (1855).
L. scabrum, Nees in Lehm. Pl. Preiss. ii. 92 (1846).
L. gracile, R.Br. Prodr. 235 (1810).
L. tenue, Benth. Fl. Austr. vii. 397 (1878).
L. leptostachyum, Benth. l. c. 397.
L. leptophyllum, Benth. l. c. 398.
L. striatum, R.Br. Prodr. 235 (1810).
L. Exsul. C. B. Clarke, Kew Bull. Add. ser. viii. 47 (1908).
L. carphoides, (F.v.M.) Benth. Fl. Austr. vii. 400 (1878).

13. *TRICOSTULARIA*, Nees in Lehm. Pugill. viii. 50 (1844).
T. compressa, Nees in Lehm. Pl. Preiss. ii. 83 (1846).
T. Neesii, Lehm. in l. c. 83.

14. *REEDIA*, F.v.M. Fragm. i. 240. t. 10 (1859).
R. spathacea, F.v.M. Fragm. i. 240. t. 10 (1859).

15. *CLADIUM*, P. Br. Hist. Jamaic. 114 (1756).
C. Drummondii, C. B. Clarke, Kew Bull. Add. ser. viii. 91 (1908).
C. Preissii, (Nees) Benth. Fl. Austr. vii. 405 (1878).
C. laxum, (Nees) Benth. l. c. 405.
C. riparium, (Nees) Benth. l. c. 405.
C. schoenoides, R.Br. Prodr. 237 (1810).
C. arthrophyllum, (Nees) F.v.M. Fragm. ix. 14 (1875).
C. glomeratum, R.Br. Prodr. 237 (1810).
C. elynanthoides, F.v.M. Fragm. ix. 31 (1875).
C. vaginale, Benth. Fl. Austr. vii. 408 (1878).
C. junceum, R.Br. Prodr. 237 (1810).

16. *RHYNCHOSPORA*, Vahl. Enum. ii. 229 (1806).
R. affinis, W. V. Fitzg. in Journ. Roy. Soc. W.A. iii. 124 (1918).
R. tenuifolia, Benth. Fl. Austr. vii. 350 (1878).

17. *CYATHOCHAETE*, Nees in Lehm. Pl. Preiss. ii. 86 (1846).
C. clandestina, (R.Br.) Benth. Fl. Austr. vii. 351 (1878).
C. australis, (Steud.) Gardner n. comb.
C. teretifolia, W. V. Fitzg. in Proc. Linn. Soc. N.S.W. xxviii. 109 (1904).

18. *TETRARIA*, P. Beauv. in Mem Inst. Fr. (Acad Sc. Par) 1812 ii. 54 (1816.)
T. australiensis, C. B. Clarke, in Engler's Botan. Jahrb. xxxv. 80 (1904).

19. *TETRARIOPSIS*, C. B. Clarke, Kew Bull. Add. ser. viii. 45 (1908).
T. octandra, (Nees) C. B. Clarke in Engler's Botan. Jahrb. xxxv. 81 (1904).

20. *GAHNIA*, R et G Forst. Char. Gen. 51 (1776).
G. trifida, Labill. Nov. Holl. Pl. i. 89. t. 116 (1804).
G. polyphylla, Benth. Fl. Austr. vii. 415 (1878).
G. deusta, (R.Br.) Benth. l. c. 416.
G. aristata, (F.v.M.) Benth. l. c. 416.
G. lanigera, (R.Br.) Benth. l. c. 415.

21. *CAUSTIS*, R.Br. Prodr. Fl. Nov. Holl. 239 (1810).
C. pentandra, R.Br. Prodr. 240 (1810).
C. dioica, R. Br. l. c. 239.
C. squamellata, C. B. Clarke, Kew Bull. Add. Ser. viii. 48 (1908).

22. *EVANDRA*, R.Br. Prodr. Fl. Nov. Holl. 239 (1810).
E. aristata, R.Br. Prodr. 239 (1810).
E. pauciflora, R.Br. l. c. 239.

23. *CHRYSITHRIX*, Linn. Mant. ii. 165 (1771).
C. dimerostigma, C. B. Clarke, in Engler's Botan. Jahrb. xxxv. 82 (1904).

24. *CHORISANDRA*, R.Br. Prodr. Fl. Nov. Holl. 221 (1810).
C. enodis, Nees in Lehm. Pl. Preiss. ii. 73 (1846).
C. multiarticulata, Nees in Ann. Nat. Hist. ser. i. iv. 48.
C. cymbaria, R.Br. Prodr. 221 (1810).

25. *CAREX*, Linn. Syst. ed. I. (1735).
C. inversa, R.Br. Prodr. 242 (1810).
C. appressa, R.Br. Prodr. 242 (1810).
C. tereticaulis, F.v.M. Fragm. viii. 256 (1874).
C. Preissii, Nees in Lehm. Pl. Preiss. ii. 94 (1846).
C. pseudocyperus, Linn. Sp. Pl. 978 (1753).
SCHOENUS Andrewsii, W. V. Fitzg. This species, if a valid Schoenus, is not sufficiently described to place it in the sequential list given for that genus.

PRINCIPES.

Palmae.

1. *LIVISTONA*, R.Br. Prodr. Fl. Nov. Holl. 267 (1810).
L. Alfredi, F.v.M. in Vict. Nat. ix. 112 (1892).
L. Eastoni, Gardner, in Bull. For. Dep. xxxii. 36 (1923).
L. inermis, R.Br. Prodr. 268 (1810).

SPATHIFLORAE.

Araceae.

1. *COLOCASIA*, Schott, Meletem. i. 18 (1832).
C. antiquorum, Schott, Meletem. bot. 18 (1832).
ZANTEDESCHIA, Spreng. Syst. iii. 765. (1826). (*Richardia*, Kunth.)
**Z. aethiopica*, Spreng. l. c. (Afr. austr). (R. *africana.*)
**R. africana*, Kunth. (Afr. austr.)
2. *TYPHONIUM*, Schott, in Wienen Zeitschr. iii. 72 (1829).
T. angustilobium, F.v.M. Fragm. x. 66 (1876).

Lemnaceae.

1. *LEMNA*, Linn. Syst. ed. I. (1735).
L. trisulca, Linn. Sp. Pl. 970 (1753).
L. minor, Linn. l. c. 970.
L. gibba, Linn. l. c. 970.
L. disperma, Hegelm. in Engler's Botan. Jahrb. xxi. 290 (1895).

FARINOSAE.

Flagellariaceae.

1. *FLAGELLARIA*, Linn. Amoen. Acad. 396 (1747).
F. indica, Linn. Sp. Pl. 333 (1753).

Restionaceae.

1. *LYGINIA*, R.Br. Prodr. Fl. Nov. Holl. 248 (1810).
L. tenax, (Labill) Gardner n. comb. (*L. barbata*, R.Br.)
2. *ECDEIOCOLEA*, F.v.M. Fragm. Phyt. Austr. viii. 236 (1874).
E. monostachya, F.v.M. Fragm. viii. 236 (1874).
3. *ANARTHRIA*, R.Br. Prodr. Fl. Nov. Holl. 248 (1810).
A. scabra, R.Br. Prodr. 249 (1810).
A. laevis, R.Br. l. c. 249.
A. gracilis, R.Br. l. c. 249.
A. prolifera, R.Br. l. c. 249.
A. polyphylla, Nees in Lehm. Pl. Preiss. ii. 63 (1846).
4. *LEPYRODIA*, R.Br. Prodr. Fl. Nov. Holl. 247 (1810).
L. hermaphrodita, R.Br. Prodr. 248 (1810).
L. monoica, F.v.M. Fragm. viii. 76 (1873).
L. Muirii, F.v.M. l. c. 78.
L. heleocharoides, Gilg. in Engler's Botan. Jahrb. xxxv. 87 (1904).
L. stricta, R.Br. Prodr. 248 (1810).
L. macra, Nees in Lehm. Pl. Preiss. ii. 60 (1846).
L. Drummondiana, Steud. Syn. Glum. ii. 248 (1855).
L. glauca, (Nees) F.v.M. Fragm. viii. 77 (1873).
L. anaectocolea, F.v.M. Fragm. viii. 78 (1873).

5. *RESTIO*, Linn. Syst. Nat. ed. 12. ii. 735 (1767).
R. megalotheca, F.v.M. Fragm. viii. 99 (1873).
R. applanatus, Spreng. Syst. i. 185 (1825).
R. confertospicatus, Steud. Syn. Glum. ii. 256 (1855).
R. sphacelatus, R.Br. Prodr. 246 (1810).
R. deformis, R.Br. l. c. 245.
R. stenostachyus, W. V. Fitzg. in Proc. Linn. Soc. N.S.W. xxviii. 108 (1904).
R. crispatus, R.Br. Prodr. 246 (1810).
R. nitens, Nees in Lehm. Pl. Preiss. ii. 59 (1846).
R. gracilior, (F.v.M.) Benth. Fl. Austr. vii. 226 (1878).
R. chaunocoleus, F.v.M. Fragm. viii. 64 (1873).
R. laxus, R. Br. Prodr. 245 (1810).
R. ornatus, Steud. Syn. Glum. ii. 256 (1855).
R. leucoblephara, Gilg, in Engler's Botan. Jahrb. xxxv. 88 (1904).
R. leptocarpoides, Benth. Fl. Austr. vii. 229 (1878).
R. amblycoleus, F.v.M. Fragm. viii. 65 (1873).
R. Dielsii, Gilg, in Engler's Botan. Jahrb. xxxv. 88 (1904).
R. tremulus, R.Br. Prodr. 245 (1810).

6. *DIELSIA*, Gilg, in Engler's Botan. Jahrb. xxxv. 88 (1904).
D. cygnorum, Gilg, in Engler's Botan. Jahrb. xxxv. 88 (1904).

7. *HOPKINSIA*, W. V. Fitzg. in Journ. W.A. Nat. Hist. Soc. i. 33 (1904).
H. calovaginata, (Gilg.) Pilger in Engler's Pflanzenfam. Nachtrage iii. zu. ii. 4. 35 (1908). (*H. scabrida*, W. V. Fitzg.)

8. *LEPTOCARPUS*, R.Br. Prodr. Fl. Nov. Holl. 250 (1810).
L. scariosus, R.Br. Prodr. 250 (1810).
L. tenax, (Labill) R. Br. Prodr. 250 (1810).
L. Brownii, Hook. f. Fl. Tasm. ii. 73. t. 136 (1860).
L. canus, Nees in Ann. Hist. ser. 1. vi. 50 (1843).
L. coangustatus, Nees in Lehm. Pl. Preiss. ii. 65 (1846).
L. humilis, Gilg. in Engler's Botan. Jahrb. xxxv. 89 (1904).
L. aristatus, R.Br. Prodr. 250 (1810).
L. erianthus, Benth. Fl. Austr. vii. 235 (1878).

9. *LOXOCARYA*, R.Br. Prodr. Fl. Nov. Holl. 249 (1810).
L. myrioclada, Gilg, in Engler's Botan. Jahrb. xxxv. 90 (1904).
L. densa (Nees) Benth. Fl. Austr. vii. 241 (1878).
L. vestita, Benth. l. c. 241.
L. virgata, Benth. l. c. 242.
L. pubescens, (R.Br.) Benth. l. c. 242.
L. fasciculata, (R.Br.) Benth. l. c. 242.
L. flexuosa, (R.Br.) Benth. l. c. 243.
L. cinerea, R.Br. Prodr. 249 (1810).

10. *HARPERIA*, W. V. Fitzg. in Journ. W.A. Nat. Hist. Soc. i. 34 (1904).
H. lateriflora, W. V. Fitzg. in Journ. W.A. Nat. Hist. Soc. i. 35 (1904).

11. *LEPIDOBOLUS*, Nees in Lehm. Pl. Preiss ii. 66 (1846).
L. Preissianus, Nees in Lehm. Pl. Preiss. ii. 66 (1846).
L. chaetocephalus, F.v.M. Fragm. viii. 84 (1873).
L. deserti, Gilg in Engler's Botan. Jahrb. xxxv. 91 (1904).

12. *CHAETANTHUS*, R.Br. Prodr. Fl. Nov. Holl. 251 (1810).
C. leptocarpoides, R.Br. Prodr. 251 (1810).

13. *ONYCHOSEPALUM*, Steud. Syn. Pl. Glum. ii. 249 (1855).
O. laxiflorum, Steud. Syn. Glum. ii. 249 (1855).

14. *HYPOLAENA*, R.Br. Prodr. Fl. Nov. Holl. 251 (1810).
H. ramosissima, Gilg, in Engler's Botan. Jahrb. xxxv. 89 (1904).
H. fasciculata, W. V. Fitzg, in Proc. Linn. Soc. N.S.W. xxviii. 108 (1904).
H. gracillima, (F.v.M.) Benth. Fl. Austr. vi. 239 (1878).
H. exsulca, R.Br. Prodr. 251 (1810).

Centrolepidaceae.

1. *HYDATELLA*, Diels, in Engler's Botan. Jahrb. xxxv. 93 (1904).
   H. australis Diels, in Engler's Jahrb. xxxv. 93 (1904).
   H. leptogyne, Diels, in l. c. 93.
2. *TRITHURIA*, Hook. fil. Fl. Tasm. ii. 79. t. 137 (1860).
   H. submersa, Hook. fil. Fl. Tasm. ii. 79. t. 138 (1860). (*T. occidentalis*, Benth.)
   T. bibracteata, Stapf.
   T. micranthera, Stapf.
3. *BRIZULA*, Heiron. in Bot. Zeit. xxx. 206 (1872).
   B. nutans, (Hook. f.) Gardner. n. comb.
   B. gracilis, (Sond.) Hieron. in Abh. Naturf. Ges. Halle xii. 92 (1873). (*Aphelia gracilis*, Sond.)
   B. Drummondii, Hieron. l. c. 92.
   B. Muelleri. Hieron. l. c. 93.
4. *APHELIA*, R.Br. Prodr. Fl. Nov. Holl. 251 (1810).
   A. cyperoides, R.Br. Prodr. 252 (1810).
5. *CENTROLEPIS*, Labill. Nov. Holl. Pl. i. 7 (1804).
   C. humillima, (F.v.M.) Benth. Fl. Austr. vii. 203 (1878).
   C. polygyna, (R.Br.) Hieron. Centrop. in Abh. Nat. Ges Halle. xii. 96 (1873).
   C. alepyroides, (Nees) Hieron. l. c. 96.
   C. mutica, (R.Br.) Hieron. l. c. 96.
   C. glabra, (F.v.M.) Hieron. l. c. 96.
   C. aristata, (R.Br.) Roem. et Schultz. Syst. Veg. i. 44 (1817).
   C. basiflora, Ostf. Det. Kgl Danske Vidensk. Selskab. iii. 2. 13 (1921).
   C. inconspicua, W. V. Fitzg. in Proc. Linn. Soc. N.S.W. xxviii. 107 (1904).
   C. Drummondii, (Nees) Hieron. Centrop. in Abh. Nat. Ges Halle. xii. 98 (1873).
   C. Banksii, (R.Br.) Roem. et Schultz. Syst. Veg. i. 44 (1817).
   C. pilosa, Hieron. Centrop. in Abh. Nat. Ges. Halle 102 (1873).
   C. strigosa, (R.Br.) Roem. et Schultz, Syst. Veg. i. 43 (1817).
   C. exserta, (R.Br.) Roem. et Schultz. l. c. 44.

Xyridaceae.

1. *XYRIS*. Linn. Gen. Pl. ii. (1737).
   X. complanata, R.Br. Prodr. 256 (1810).
   X, pauciflora, Willd. Phyt. 2. t. 1 (1794).
   X. lacera, R.Br. Prodr. 257 (1810).
   X. flexifolia, R.Br. l. c. 256.
   X. lanata, R.Br. l. c. 257.
   X. laxiflora, F.v.M. Fragm. viii. 203 (1874).
   X. gracillima, F.v.M. l. c. 203.

Eriocaulaceae.

1. *ERIOCAULON*, Linn. Gen. Pl. ed. 2. 35 (1742).
   E. setaceum, Linn. Sp. Pl. 87 (1753).
   E. quinquangulare, Linn. l. c. 87.
   E. cinereum, R.Br. Prodr. 254 (1810).
   E. nigricans, R.Br. l. c. 254.
   E. lividum, F.v.M. Fragm. i. 92 (1858).

Commelinaceae.

1. *CYANOTIS*, D. Don. Prodr. Fl. Nep. 45 (1825).
   C. axillaris, D. Don. Prodr. Fl. Nep. 46 (1825).
2. *COMMELINA*, (Plum.) Linn. Syst. ed. I. (1735).
   C. ensifolia, R.Br. Prodr. 269 (1810).
   C. lanceolata, R.Br. l. c. 269.
3. *ANEILEMA*, R.Br. Prodr. Fl. Nov. Holl. 270 (1810).
   A. gramineum, R.Br. Prodr. 270 (1810).
4. *CARTONEMA*, R.Br. Prodr. Fl. Nov. Holl. 271 (1810).
   C. philydroides, F.v.M. Fragm. i. 62 (1858).
   C. spicatum, R.Br. Prodr. 271 (1810).
   C. parviflorum, Hassk. Flora Regensb. 365 (1869).

Pontederiaceae.

1. *MONOCHORIA*, Presl. Reliq. Haenk. i. 127 (1827).
   M. cynea, F.v.M. Fragm. viii. 44 (1872).

Philydraceae.

1. *PHILYDRUM*, Banks in Gaertn. Fruct. i. 62 (1788).
   P. lanuginosum, Banks in Gaertn. Fruct. i. 62 (1788).
2. *PRITZELIA*, F.v.M. Papuan Plants. 13 (1875).
   P. pygmaea, (R.Br.) F.v.M. Papuan Plants 13 (1875).

Juncaceae.

1. *JUNCUS*, Linn. Gen. Pl. ed. i. 104 (1737).
   J. gracilis, R.Br. Prodr. 259 (1810).
   J. planifolius, R.Br. l. c. 259.
   J. caespititius, E. Mey. in Lehm. Pl. Preiss. ii. 47 (1846).
   J. bufonius, Linn. Sp. Pl. 328 (1753).
   J. plebius, R.Br. Prodr. 259 (1810). (*J. homalocaulis*, F.v.M.)
   J. effusus, Linn. Sp. Pl. ed. i. 326 (1753). (*J. communis*, E. Mey.)
   J. pallidus, R.Br. Prodr. 258 (1810).
   J. radula, Buchenau Krit. Verzeichn. aller Juncac. 38 (1880).
   J. maritimus, Lam. Encycl. Meth. iii. 264 (1789).
   J. polyanthemus, Buchen, in Engler's Botan. Jahrb. xx. 261 (1895).
   J. holoschoenus, R.Br. Prodr. 259 (1810).
2. *LUZULA*, D. C. Fl. France, iii. 158 (1805).
   L. campestris, D. C. Fl. France, iii. 161 (1805).

Liliaceae.

1. *BURCHARDIA*, R.Br. Prodr. Fl. Nov. Holl. 272 (1810).
   B. umbellata, R.Br. Prodr. 273 (1810).
   B. multiflora, Lindl. Swan Riv. App. 58 (1839).
2. *WURMBAEA*, Thunb. Nov. Gen. i. 18. t. 1 (1781). (*Anguillaria*, R.Br. p.p.)
   W. tubulosa, Benth. Fl. Austr. vii. 28 (1878).
   W. pygmaea (Endl.) Benth. l. c. 28.
   W. dioica, (R.Br.) F.v.M. Fragm. x. 119 (1877).
3. *IPHIGENIA*, Kunth, Enum. Pl. iv. 212 (1843).
   I. indica, Kunth. enum. Pl. iv. 213 (1843).
   ASPHODELUS, (Tourn.) Linn. Syst. ed. I. (1735).
   **A. fistulosus*, Linn. (Reg. Meditorr.; Oriens.)
4. *BULBINE*, Linn. Hort. Cliff. 122 (1737).
   B. semibarbata, (R.Br.) Haw. Rev. Pl. Succul. 33 (1821).
5. *THYSANOTUS*, R.Br. Prodr. Fl. Nov. Holl. 282 (1810).
   T. multiflorus, R.Br. Prodr. 285 (1810).
   T. triandrus, (Labill) R.Br. l. c. 284.
   T. Bentianus, Ewart et J. White, in Proc. Roy. Soc. Vict. n. s. xxi. 546 (1909).
   T. glaucus, Endl. in Lehm. Pl. Preiss. ii. 38 (1846).
   T. Drummondii, Baker in Journ. Linn. Soc. xv. 341 (1876).
   T. pauciflorus, R.Br. Prodr. 285 (1810).
   T. asper, Lindl. Swan Riv. App. 58 (1839).
   T. gageoides, Diels, in Engler's Botan. Jahrb. xxxv. 99 (1904).
   T. chinensis, Benth. Fl. Hong kong. 37 (1861). (*T. chrysantherus*, F.v.M.)
   T. isantherus, R.Br. Prodr. 283 (1810)
   T. tenellus, Endl. in Lehm. Pl. Preiss. ii. 37 (1846).
   T. scaber, Endl. in l. c. 37.
   T. tuberosus, R.Br. Prodr. 282 (1810).
   T. thyrsoides, Baker, in Journ. Linn. Soc. xv. 336 (1876).
   T. Patersoni, R.Br. Prodr. 284 (1810).
   T. dichotomus, (Labill) R.Br. l. c. 284.
   T. arbuscula, Baker, in Journ. Linn. Soc. xv. 339 (1876).
   T. anceps, Lindl. Swan Riv. App. 58 (1839).
6. *DICHOPOGON*, Kunth. Enum. Pl. iv. 622 (1843).
   D. strictus, (R.Br.) J. G. Baker in Journ. Linn. Soc. xv. 319 (1876).
   D. fimbriatus (R.Br.) Macbride in Contr. Gray Herb. in. s. lvi. 2 (1918). (*D. Sieberianus*, Kunth.)

7. *ARTHROPODIUM*, R.Br. Prodr. Fl. Nov. Holl. 276 (1810).
A. capillipes, Endl. in Lehm. Pl. Preiss. ii. 34 (1846).
A. Preissii, Endl. in l. c. 35.

8. *CHAMAESCILLA*, F.v.M. Fragm. vii. 68 (1870).
C. corymbosa, (R.Br.) F.v.M. Fragm. vii. 68 (1870).
C. spiralis, (Endl.) F.v.M. l. c. 68.

9. *TRICORYNE*, R.Br. Prodr. Fl. Nov. Holl. 278 (1810).
T. elatior, R.Br. Prodr. 278 (1810).
T. humilis, Endl. in Lehm. Pl. Preiss. ii. 36 (1846).

10. *AGROSTOCRINUM*, F.v.M. Fragm. Phyt. Austr. ii. 95 (1860).
A. scabrum (R.Br.) Baill. in Bull. Soc. Linn. Par. ii. 1119 (1893). (*A. stypandroides*, F.v.M.)

11. *CAESIA*, R.Br. Prodr. Fl. Nov. Holl. 277 (1810).
C. vittata, R.Br. Prodr. 277 (1810).
C. parviflora, R.Br. l. c. 277.
C. rigidifolia, F.v.M. Fragm. x. 48 (1876).

12. *CORYNOTHECA*, F.v.M. Fragm. Phyt Austr. vii. 68 (1870).
C. lateriflora, (R.Br.) F.v.M. Fragm. vii. 68 (1870).
C. micrantha, (Lindl.) Macbride, Contr. Grey. Herb. lvi. 3 (1918). (*C. dichotoma*, F.v.M.)
C. acanthoclada, F.v.M. Fragm. vii. 68 (1870).

13. *HODGSONIOLA*, F.v.M. Fragm. Phyt. Austr. ii. 176 (1861).
H. junciformis, F.v.M. Fragm. ii. 176 (1861).

14. *STYPANDRA*, R.Br. Prodr. Fl. Nov. Holl. 278 (1810).
S. imbricata, R.Br. Prodr. 279 (1810).
S. grandiflora, Lindl. Swan Riv. App. 57 (1839).

15. *DIANELLA*, Lam. Encycl. Mèth. ii. t. 250 (1786).
D. revoluta, R.Br. Prodr. 280 (1810)
D. coerulea, Sims. Bot. Mag. t. 505 (1799).

16. *BARTLINGIA*, F.v.M. Fragm. vii. 88 (1870). (*Laxmannia*, R.Br. non Forst.)
B. grandiflora, (Lindl.) F.v.M. Cens. Austr. Pl. 118 (1882).
B. squarrosa, (Lindl.) F.v.M. l. c. 118
B. minor, (R.Br.) F.v.M. l. c. 118.
B. ramosa, (Lindl.) F.v.M. Fragm. vii. 88 (1870).
B. sessiliflora, (Dcne) F.v.M. in Proc. Roy. Soc. Tasm. 116 (1877).
B. brachyphylla, F.v.M. Cens. Austr. P. 119 (1882).
B. sessilis, (Lindl.) F.v.M l. c. 119.

17. *SOWERBAEA*, Smith, in Trans. Linn. Soc. v. 159 (1800).
S. multicaulis, E. Pritzel, in Engler's Jahrb. xxxv. 99 (1904).
S. laxiflora, Lindl Bot. Reg. t. 10 (1841).

18. *STAWELLIA*, F.v.M. Fragm. Phyt. Austr. vii. 85 (1870).
S. dimorphantha, F.v.M. Fragm. vii. 85 (1870).
S. gymnocephala, Diels, in Engler's Jahrb. xxxv. 100 (1904).

19. *BORYA*, Labill. Nov. Holl. Pl. Sp. i. 81 t. 107 (1804).
B. nitida, Labill. Nov. Holl. Pl. Sp. i. 81. t. 107 (1804).
B subulata Gardner Bull. For. Dep. xxxii. 38 (1923).

20. *JOHNSONIA*, R.Br. Prodr. Fl. Nov. Holl. 287 (1810).
J. lupulina, R.Br. Prodr. 287 (1810).
J. pubescens, Lindl. Swan. Riv. App. 57 (1839).
J. acaulis, Endl. in Lehm. Pl. Preiss. ii. 41 (1846).

21. *HENSMANIA*, W. V. Fitzg. in Proc. Linn. Soc. N.S.W. xxviii. 105 (1903).
H. turbinata, (Endl.) W. V. Fitzg in Proc. Linn. Soc. N.S.W. xxviii. 106 (1903).

22. *ARNOCRINUM*, Endl. in Lehm. Pl. Preiss. ii. 41 (1846).
A. Drummondii, Endl. in. Lehm. Pl. Preiss. ii. 41 (1846).
A. Preissii, Lehm. in l. c. 42.

23. *DASYPOGON*, R.Br. Prodr. Fl. Nov. Holl. 263 (1810).
D. bromeliaefolius, R.Br. Prodr. 263 (1810).
D. Hookeri, Drumm. in Hook. Lond. Journ. Bot. ii. 168 (1843).

24. *ACANTHOCARPUS*, Lehm. in Lehm. Pl. Preiss. ii. 274 (1847).
A. Preissii, Lehm. in Lehm. Pl. Preiss. ii. 274 (1847).
A. serra, (Endl.) Ewart, Proc. Roy. Soc. Vict. xxviii. n. s. 220 (1916).
A. fimbriata, (F.v.M.) Ewart, l. c. 220.

25. *LOMANDRA*, Labill. Nov. Holl. Pl. Sp. i. 92 (1804). (*Xerotes*, R.Br.)
L. rigida, Labill. Nov. Holl. Pl. Sp. i. 93. t. 120 (1804).
L. Drummondii, (F.v.M.) Ewart, in Proc. Roy. Soc. Vict. xxviii. n. s. 219 (1916).
L. Sonderi, (F.v.M.) Ewart, l. c. 219.
L. odora, (Endl.) Ewart, l. c. 219.
L. multiflora, (R.Br.) J. Britt. in Bot. Cook's Voy. 95 (1905).
L. Ordii, (F.v.M.) Ewart in Proc. Roy. Soc. Vict. xxviii. n. s. 219 (1916).
L. Endlicheri, (F.v.M.) Ewart, l. c. 219.
L. sericea, (Endl.) Ewart, l. c. 219.
L. purpurea, (Endl.) Ewart, l. c. 219.
L. Preissii, (Endl.) Ewart, l. c. 219.
L. effusa, (Lindl.) Ewart, l. c. 219.
L. micrantha, (Endl.) Ewart, l. c. 219.
L. caespitosa, (Benth.) Ewart, l. c. 220.
L. hermaphrodita, (C. Andrews) Gardner. n. comb.
L. pauciflora, (R.Br.) Ewart, in Proc. Roy. Soc. Vict. xxviii. n. s. 219 (1916).
L. glauca, (R.Br.) Ewart, l. c. 220.
L. rupestris, (Endl.) Ewart, l. c. 220.
L. collina, (R.Br.) Ewart, l. c. 220.
L. suaveolens, (Endl.) Ewart, l. c. 220.
L. spartea, (Endl.) Ewart, l. c. 220.
L. leucocephala, (R.Br.) Ewart, l. c. 220.
L. hastilis, (R.Br.) Ewart, l. c. 220.

26. *XANTHORRHOEA*, Smith, in Trans. Linn. Soc. iv. 219 (1798).
X. gracilis, Endl. in Lehm. Pl. Preiss. ii. 39 (1847).
X. reflexa, Herbert, in Journ. Roy. Soc. W.A. vi. pt. i. 33 (1920).
X. brevistyla, Herbert, l. c. vii. 82 (1921).
X. Preissii, Endl. in Lehm. Pl. Preiss. ii. 39 (1847).
X. nana, Herbert, in Journ. Roy. Soc. W.A. vii. 83 (1921).

27. *KINGIA*, R.Br. in King's Narr. and Surv. Austr. Coasts, ii. 529 (1827).
K. australis, R.Br. in l. c. ii. 535, t. c. (1827).

28. *BAXTERIA*, R.Br. in Hook. Lond. Journ. Bot ii. 492. t. 13-15 (1843).
B. australis, R.Br. in Hook. Lond. Journ. Bot. ii. 492. t. 13-15 (1843).

29. *CALECTASIA*, R.Br. Prodr. Fl. Nov. Holl. 263 (1810).
C. cyanea, R.Br. Prodr. 264 (1810).

30. *ASPARAGUS*, (Tourn.) Linn. Syst. ed. I. (1735).
A. racemosus, Willd. Sp. Pl. ii. 152 (1799).

31. *RHIPOGONUM*, Forst. Char. Gen. 49. t. 25 (1776).
R. album, R.Br. Prodr. 293 (1810).

Haemodoraceae.

1. *HAEMODORUM*, Smith, in Trans. Linn. Soc. 213 (1798).
H. sparsiflorum, F.v.M. Fragm. vii. 117 (1870).
H. spicatum, R.Br. Prodr. 300 (1810).
H. brevisepalum, Benth. Fl. Austr. vi. 420 (1873).
H. paniculatum, Lindl. Swan Riv. App. 44 (1839).
H. laxum, R.Br. Prodr. 300 (1810).
H. simplex, Lindl. Swan Riv. App. 44 (1839).
H. simulans, F.v.M. Fragm. vii. 117 (1870).
H. longifolium, W. V. Fitzg. in Journ. Roy. Soc. W.A. iii. 127 (1918).
H. flaviflorum, W. V. Fitzg. in l. c. 128.
H. parviflorum, Benth. Fl. Austr. vi. 423 (1873).

2. *PHLEBOCARYA*, R.Br. Prodr. Fl. Nov. Holl. 301 (1810).
P. ciliata, R.Br. Prodr. 301 (1810).
P. pilosissima, (F.v.M.) Benth. Fl. Austr. vi. 425 (1873).
P. filifolia, (F.v.M.) Benth. l. c. 425.

Amaryllidaceae.

1. *CRINUM*, Linn. Gen. Pl. 97 (1737).
   C. asiaticum, Sp. Pl. 292 (1753).
2. *HYPOXIS*, Linn. Syst. ed. x. 986 (1759).
   H. glabella, R.Br. Prodr. 289 (1810).
   H. occidentalis, Benth. Fl. Austr. vi. 451 (1873).
   H. leptantha, Benth. l. c. 451.
3. *MACROPIDIA*, Drumm. e. Harv. in Hook. Kew Journ. vii. 57 (1855).
   M. fuliginosa, (Hook) Druce in Rep. Bot. Exch. Cl. Brit. Isles, 1916, 634 (1917). (*M. fumosa*, Drumm.)
4. *TRIBONANTHES*, Endl. Nov. Stirp. dec. i. 27 (1839).
   T. brachypetala, Lindl. Swan Riv. App. 44 (1839).
   T. uniflora, Lindl. l. c. 44.
   T. australis, Endl. Nov. Stirp. dec. i. 27 (1839).
   T. variabilis, Lindl. Swan Riv. App. 44 (1839).
   T. longipetala, Lindl. l. c. 44.
5. *BLANCOA*, Lindl. Swan Riv. App. 45 (1839).
   B. canescens, Lindl. Swan Riv. App. 45 (1839).
6. *CONOSTYLIS*, R.Br. Prodr. Fl. Nov. Holl. 300 (1810).
   C. Androstemma, F.v.M. Fragm. viii. 19 (1873). (*A. junceum*, Lindl. 1839.)
   C. Bealiana, F.v.M. Fragm. ix. 50 (1875).
   C. filifolia, F.v.M. l. c. viii. 18 (1873).
   C. spinuligera, (F.v.M.) Benth. Fl. Austr. vi. 438 (1873).
   C. bromelioides, Endl. in Lehm. Pl. Preiss. ii. 18 (1846).
   C. phathyrantha, Diels, in Engler's Botan. Jahrb. xxxv. 111 (1904).
   C. aculeata, R.Br. Prodr. 300 (1810).
   C. laxiflora, Benth, Fl. Austr. vi. 439 (1873).
   C. cymosa, (F.v.M.) Benth. l. c. 439.
   C. Harperiana, W. V. Fitzg. in Proc. Linn. Soc. N.S.W. xxviii. 106 (1904).
   C. serrulata, R.Br. Prodr. 300 (1810).
   C. caricina, Lindl. Swan Riv. App. 45 (1839).
   C. gladiata, Benth. Fl. Austr. vi. 434 (1873).
   C. seorsiflora, F.v.M. Fragm. i. 158 (1859).
   C. teretiuscula, F.v.M. l. c. viii. 18 (1872).
   C. stylidioides, F.v.M. l. c. 17.
   C. prolifera, Benth. Fl. Austr. vi. 436 (1873).
   C. racemosa, Benth. l. c. 436.
   C. candicans, Endl. Nov. Stirp. dec. 20 (1839).
   C. dealbata, Lindl. Swan Riv. App. 45 (1839).
   C. Preissii, Endl. in Lehm. Pl. Preiss. ii. 18 (1846).
   C. robusta, Diels. in Engler's Botan. Jahrb. xxxv. 109 (1904).
   C. bracteata, Engl. in Lehm. Pl. Preiss. ii. 16 (1846).
   C. involucrata, Endl. l. c. 23.
   C. juncea, Endl. Nov. Stirp. dec. 19 (1839).
   C. vaginata, Endl. in Lehm Pl. Preiss. ii. 23 (1846).
   C. petrophiloides, (F.v.M.) Benth. Fl. Austr. vi. 431 (1873).
   C. setosa, Lindl. Swan Riv. App. 44 t. 6 (1839).
   C. aurea, Lindl. l. c. 44.
   C. melanopogon, Endl. in Lehm. Pl. Preiss. ii. 18 (1846).
   C. setigera, R.Br. Prodr. 300 (1810).
   C. psyllium, Endl. in Lehm. Pl. Preiss. ii. 1 (1846).
   C. Dielsii, W. V. Fitzg. in Journ. Muell. Bot. Soc. W.A. i. n. 11 82 (1903).
   C. villosa, Benth. Fl. Austr. vi. 433 (1873).
   C. Drummondii, Benth. l. c. 433.
   C. breviscapa, R.Br. Prodr. 301 (1810).
7. *ANIGOZANTHOS*, Labill. Voy. i. 409, t. 22 (1798).
   A. rufa, Labill. Voy. i. 411. t. 22 (1798).
   A. pulcherrima, Hook. Bot. Mag. t. 4180 (1845).
   A. flavida, Redoute et D.C. Lil. t. 176 (1807).
   A. Preissii, Endl. in Lehm. Pl. Preiss. ii. 26 (1846).
   A. humilis, Lindl. Swan Riv. App. 46. t. 6b (1839). (*A. Dorrienii*, Domin.)
   A. viridis, Endl. in Lehm. Pl. Preiss. ii. 25 (1847).
   A. Manglesii, D. Don in Sweet Brit. Fl. Gard. ser. ii. t. 265 (1836).
   A. bicolor, Endl. in Lehm. Pl. Preiss. ii. 26 (1847). (*A. Gabrielae*, Domin.)

Taccaceae.

1. *TACCA*, Forst Char. Gen. 65 (1776).
 T. pinnatifida, R. et G. Forst, Char. Gen. 65 (1776).

Dioscoreaceae.

1. *DIOSCOREA*, (Plum.) Linn. Gen. ed. i. 306 (1737).
 D. hastifolia, Endl. in Lehm. Pl. Preiss. ii. 33 (1846).

Iridaceae.

ROMULEA, Maratti, Diss. Romul. et Saturn. Romae. 13. t. 1 (1772).
**R. rosea*, (Linn.) Eckl. (Afr. austr.)
**R. parviflora*, (Salisb.) J. Britten. (Europ. occ.)
HOMERIA, Vent. Dec. Gen. Nov. 5 (1808).
**H. collina*, (Thunb.) Vent. (Afr. austr.).
**H. miniata*, Sweet. (Afr. austr.)

1. *PATERSONIA*, R.Br. in Bot. Mag. t. 1041 (1807).
 P. occidentalis, R.Br. Prodr. 304 (1810).
 P. umbrosa, Endl. in Lehm. Pl. Preiss. ii. 31 (1846).
 P. xanthina, F.v.M. Fragm. i. 214 (1859).
 P. limbata, Endl. in Lehm. Pl. Preiss. ii. 29 (1846).
 P. juncea, Lindl. Swan River App. 58 (1839).
 P. Maxwelli, (F.v.M.) Benth. Fl. Austr. vi. 405 (1873).
 P. pygmaea, Lindl. Swan Riv. App. 58 (1839).
 P. lanata, R.Br. Prodr. 303 (1810).
 P. rudis, Endl. in Lehm. Pl. Preiss. ii. 29 (1846).
 P. macrantha, Benth. Fl. Austr. vi. 407 (1873).
 P. Drummondii, (F.v.M.) Benth. l. c. 407.
 P. inaequalis, Benth. l. c. 408.
 P. graminea, Benth. l. c. 408.
 P. babianoides, Benth. l. c. 408.

2. *ORTHROSANTHUS*, Sweet, Fl. Austral. t. 11 (1827).
 O. multiflorus, Sweet, Fl. Austr. t. 11 (1827).
 O. Muelleri, Benth. Fl. Austr. vi. 411 (1873).
 O. laxus, (Endl.) Benth. l. c. 411.
 O. gramineus, (Endl.) Benth. l. c. 411.
 O. polystachyus, Benth. l. c. 411.

MICROSPERMAE.

Burmanniaceae.

1. *BURMANNIA*, Linn. Syst. Nat. 8 (1737).
 B. disticha, Linn. Sp. Pl. 287 (1753).

Orchidaceae.

II. Monandrae-Acrotonae.

a.—Acranthae-Convolutae.

Thelymitreae.

1. *THELYMITRA*, Forst. Char. Gen. 97 (1776).
 T. ixioides, Swartz, in K. Acad. Stockh. Handl. 228, t. 3 (1800).
 T. canaliculata, R.Br. Prodr. 314 (1810).
 T. crinita, Lindl. Swan Riv. App. 49 (1839).
 T. fasciculata, Fitzg. Austr. Orc. ii. t. 29 (1888).
 T. aristata, Lindl. Gen. et. sp. Orch. 521 (1840).
 T. longifolia, Forst. Char. Gen. 98, t. 49 (1776).
 T. pauciflora, R.Br. Prodr. 314 (1810).
 T. mucida, Fitz. in Gard. Chron. ii. 497 (1882).
 T. villosa, Lindl. Swan Riv. App. 49, t. 8c (1839).
 T. tigrina, R.Br. Prodr. 315 (1810).
 T. stellata, Lindl. Swan Riv. App. 49 (1839).
 T. fusco-lutea, R.Br. Prodr. 315 (1810).
 T. flexuosa, Endl. Nov. Stirp. Dec. 23 (1839).
 T. antennifera, (Lindl.) Hook, f. Fl. Tasm. ii. 4, t. 101a (1860).
 T. psammophila, C. Andrews, in Journ. W.A. Nat. Hist. Soc. ii. 57 (1905).
 T. carnea, R.Br. Prodr. 314 (1810).
 T. Macmillani, F.v.M. Fragm. v. 93 (1865).
 T. variegata, (Lindl.) Benth. Fl. Austr. vi. 323 (1873).

2. *EPIBLEMA*, R.Br. Prodr. Fl. Nov. Holl. 315 (1810).
   E. grandiflorum R.Br. Prodr. 315 (1810).

   Diurideae.

3. *DIURIS*, Sm. in Trans. Linn. Soc. iv. 122 (1798).
   D. laevis Fitzg. in Gard. Chron. xvii. pt. i. 495 (1882).
   D. Purdei, Diels, in Journ. Muell. Bot. Soc. W.A. ii. 79 (1903).
   D. setacea, R.Br. Prodr. 316 (1810).
   D. emarginata, R.Br. l. c. 316.
   D. longifolia, R.Br. l. c. 316.
   D. pauciflora, R.Br. l. c. 316.
   D. carinata, Lindl. Gen et Sp. Orch. 510 (1840).

4. *MICROTIS*, R.Br. Prodr. Fl. Nov. Holl. 320 (1810).
   M. porrifolia, R.Br. Prodr. 320 (1810).
   M. truncata, Rogers, in Trans. Roy. Soc. S. Austr. xliv. 326 (1920).
   M. parviflora, R.Br. Prodr. 321 (1810).
   M. media, R.Br. l. c. 321.
   M. alba, R.Br. l. c. 321.
   M. orbicularis, Rogers, in Trans. Roy. Soc. S. Austr. xxxi. 63 (1907).
   M. atrata, Lindl. Swan Riv. App. 54 (1839).
   M. pulchella, R.Br. Prodr. 321 (1810).
   M. gymnadenoides, Diels, in Journ. Muell. Bot. Soc. ii. 79 (1903).

5. *GOADBYELLA*, Rogers, in Trans. Roy. Soc. South Australia, li. 294 (1927).
   G. gracilis, Rogers, in Trans. Roy. Soc. S.A. li. 294 (1927).

6. *PRASOPHYLLUM*, R.Br. Prodr. Fl. Nov. Holl. 317 (1810).
   P. australe R.Br. Prodr. 318 (1810).
   P. elatum, R.Br. l. c. 318.
   P. Muelleri, C. Andrews, in Journ. Muell. Bot. Soc. W.A. Ser. I. ix. 19 (1903).
   P. regium, Rogers, in Trans. Roy. Soc. S. Austr. xlii. 27 (1918).
   P. lanceolatum, Rogers, in l. c. xliv. 325 (1920).
   P. ellipticum, Rogers, in l. c. 325.
   P. fimbria, Reichb. fil. Beitr. 60 (1871).
   P. hians, Reichb. f. l. c. 59.
   P. cyphochilum, Benth. Fl. Austr. vi. 340 (1873).
   P. ovale, Lindl. Swan Riv. App. 54 (1839).
   P. macrostachyum, R.Br. Prodr. 318 (1810).
   P. attenuatum, R. Fitzg. in Gard. Chron. xvii. i. 495 (1882).
   P. plumaeforme, R. Fitzg. l. c. 495.
   P. triangulare, R. Fitzg. l. c. 495.
   P. parvifolium, Lindl. Swan Riv. App. 54 (1839).
   P. gibbosum, R.Br. Prodr. 318 (1810).
   P. cucullatum, Reichb. fil. Beitr. 59 (1871).

   Pterostylideae.

7. *CALEANA*, R.Br. Prodr. Fl. Nov. Holl. 329 (1810).
   C. nigrita, Lindl. Swan Riv. App. 54 (1839).

8. *SPICULAEA*, Lindl. Swan Riv. Append. 56 (1839).
   S. ciliata, Lindl. Swan Riv. App. 56 (1839).

9. *DRAKAEA*, Lindl. Bot. Reg. xxv. App. 55 (1834).
   D. elastica, Lindl. Swan Riv. App. 55 (1839).
   D. Fitzgeraldii, Schltr. in Fedde, Repert. Spec. Nov. xvii. 81 (1921).
   D. glyptodon, Fitzg. in Gard. Chron. i. 494 (1882).
   D. Jeanensis, Rogers, in Trans. Roy. Soc. S.A. xliv. 322. t. 13 (1920).

10. *PTEROSTYLIS*, R.Br. Prodr. Fl. Nov. Holl. 326 (1810).
   P. nana, R.Br. Prodr. 327 (1810).
   P. pyramidalis, Lindl. Swan Riv. App. 53 (1839).
   P. reflexa, R.Br. Prodr. 327 (1810).
   P. robusta, Rogers, in Trans. Roy. Soc. S. Austr. ii. 296 (1927).
   P. constricta, O. H. Sargent, in Journ. W.A. Nat. Hist. Soc. iv. 24 (1907).
   P. recurva, Benth. Fl. Austr. vi. 360 (1873).
   P. turfosa, Endl. in Lehm. Pl. Preiss. ii. 5 (1846).
   P. rufa, R.Br. Prodr. 327 (1810).
   P. Sargenti, C. Andrews, in Journ. W.A. Nat. Hist. Soc. ii. 57 (1905).
   P. vittata, Lindl. Swan Riv. App. 53 (1839).

Caladenieae.

11. *ACIANTHUS*, R.Br. Prodr. Fl. Nov. Holl. 321 (1810).
A. exsertus, R.Br. Prodr. 321 (1810)—A species stated to occur in Western Australia, *but no authentic record seen by me.*

12. *CYRTOSTYLIS*, R.Br. Prodr. Fl. Nov. Holl. 322 (1810).
C. reniformis, R.Br. Prodr. 322 (1810).

13. *CALOCHILUS*, R.Br. Prodr. Fl. Nov. Holl. 320 (1810).
C. Robertsoni, Benth. Fl Austr. vi. 315 (1873).

14. *ERIOCHILUS*, R.Br. Prodr. Fl. Nov. Holl. 323 (1810).
E. scaber Lindl. Swan Riv. App. 53 (1839).
E. tenuis, Lindl. l. c. 53.
E. dilatatus, Lindl. l. c. 53.
E. multiflorus Lindl. l. c. 53.

15. *LYPERANTHUS*, R.Br. Prodr. Fl. Nov. Holl. 325 (1810).
L. nigricans R.Br. Prodr. 325 (1810).
L. serratus, Lindl. Gen. et Sp. Orch. 393 (1840).
L. Forrestii, F.v.M. in Wing's S. Sc. Rec. ii. 55 (1882).

16. *LEPTOCERAS*, Lindl. Swan Riv. App. 58 (1839).
L. fimbriata, Lindl. Swan Riv. App. 53 (1839).

17. *CALADENIA*, R.Br. Prodr, Fl. Nov. Holl. 323 (1810).
C. Menziesii, R.Br. Prodr. 325 (1810).
C. Bryceana, Rogers, in Trans. Roy. Soc. S. Austr. xxxviii. 359. t. 18 (1914).
C. discoidea, Lindl. Swan Riv. App. 52 (1839).
C. Cairnsiana, F.v.M. Fragm. vii. 31 (1869).
C. multiclavia, Reichb. fil. Beitr. 64 (1871).
C. reticulata, R. Fitzg. Austr. Orch. II. ix. 2 (1883).
C. filamentosa, R.Br. Prodr. 324 (1810).
C. Dorrienii, Domin, in Journ. Linn. Soc. xli. 251 (1913).
C. tentaculata, Tate, in Trans. Roy. Soc. S. Austr. xii. 130 (1889).
C. Patersoni, R.Br. Prodr. Fl. Nov. Holl. 324 (1810) v. Longicauda, (Lindl.) Rogers.
C. pectinata, Rogers, in Trans. Roy. Soc. S. Austr. xliv. 352 (1920).
C. lobata, R. Fitzg. in Gard. Chron. xvii. i. 461 (1882).
C. dilatata, R.Br. Prodr. 325 (1810).
C. radialis, Rogers, in Trans. Roy. Soc. S. Austr. li. 296 (1927).
C. clavigera, A. Cunn. ex Lindl. Gen et Sp. Orch. 422 (1840).
C. plicata, R. Fitzg. in Gard. Chron. vii. i. 461 (1882).
C. cristata, Rogers, in Trans. Roy. Soc. S. Austr. xlvii. 337 (1923).
C. macrostylis, Fitzg. in Gard. Chron. xvii. i. 462 (1882).
C. Drummondii, Benth. Fl. Austr. vi. 383 (1873).
C. triangularis, Rogers, in Trans. Roy. Soc. S. Austr. li. 10 (1927).
C. hirta, Lindl. Swan Riv. App. 52 (1839).
C. lavandulacea, Rogers, in Trans. Roy. Soc. S. Austr. li. 11 (1927).
C. Roei, Benth. Fl. Austr. vi. 383 (1873).
C. Doutchae, O. H. Sargent, in Journ. Bot. lix. 175 (1921).
C. Barbarossae, Reichb. fil. Beitr. 64 (1871).
C. flava, R.Br. Prodr. 324 (1810).
C. paniculata, R. Fitzg. in Gard. Chron. xvii. I. 461 (1882).
C. Purdieana, C. Andrews, in Journ. Proc. Muell. Bot. Soc. i. 39 (1902).
C. unita, R. Fitzg. in Gard. Chron. xvii. i. 461 (1882).
C. latifolia, R.Br. Prodr. 324 (1810).
C. reptans, Lindl. Swan Riv. App. 52 (1839).
C. nana, Endl. in Lehm. Pl. Preiss. ii. 7 (1846).
C. tenuis, R. Fitzg. in Gard. Chron. xvii. i. 462 (1882).
C. carnea, R.Br. Prodr. 324 (1810).
C. aphylla, Benth. Fl. Austr. vi. 387 (1873).
C. saccharata, Reichb. fil. Beitr. 63 (1871).
C. deformis, R.Br. Prodr. 324 (1810).
C. sericea, Lindl. Swan Riv. App. 52 (1839).
C. gemmata, Lindl. l. c. 52. (*C. Gertrudae,* Ostf.)
C. ixioides, Lindl. l. c. 52.

18. *GLOSSODIA*, R.Br. Prodr. Fl. Nov. Holl. 325 (1810).
G. Brunonis, Endl. Nov. Stirp. Dec. 16 (1839).
G. intermedia, R. Fitzg. in Gard. Chron. xvii. I. 462 (1882).
G. emerginata, Lindl. Gen et Sp. Orch. 424 (1840).

Pogonieae.

19. *CORYSANTHES*, R.Br. Prodr. Fl. Nov. Holl. 328 (1810).
C. fimbriata, R.Br. Prodr. 328 (1810).

20. *CRYPTOSTYLIS*, R.Br. Prodr. Fl. Nov. Holl. 317 (1810).
C. ovata, R.Br. Prodr. 317 (1810).

Gastrodinae.

21. *GASTRODIA*, R.Br. Prodr. Fl. Nov. Holl. 330 (1810).
G. sesamoides, R.Br. Prodr. 330 (1810).

Rhizanthellinae.

22. *RHIZANTHELLA*, Rogers, in Journ. Roy. Soc. W. Austr. xiv. 1. **(1929).**
R. Gardneri, Rogers, in Journ. Roy. Soc. W. Austr. xiv. 1. (1929).

Pleuranthae.

Convolutae.

Crytopodiinae.

23. *EULOPHIA*, R.Br. (ex. Lindl.) in Bot. Reg. t. 686 (1823).
E. venosa, (F.v.M.) Benth. Fl. Austr. vi. 300 (1873).

II.—DUPLICATE.—Sympodiales.

Dendrobiinae.

24. *DENDROBIUM*, Swartz, in Nov. Act. Upsal. vi. 82 (1799).
D. dicuphum, F.v.M. Fragm. viii. 28 (1871).

Cymbidiinae.

25. *CYMBIDIUM*, Swartz, in Nov. Act. Upsal. vi. 70 (1799).
C. canaliculatum, R.Br. Prodr. 331 (1810).

DICOTYLEDONEAE.

ARCHICHLAMYDEAE.

Casuarinaceae.

1. *CASUARINA*, (Rumph.) Linn. Amoen. Acad. iv. 143 (1759).
C. Stowardi, S. Moore, in Journ. Linn. Soc. Bot. xlv. 193 (1920).
C. acutivalvis, F.v.M. Fragm. x. 61 (1876).
C. glauca, Sieber, in Spreng. Syst. Veg. iii. 803 (1826).
C. Prinsepiana, C. Andrews, in Journ. W. Austr. Nat. Hist. Soc. i. 43 (1904).
C. lepidophloia, F.v.M. Fragm. x. 115 (1877).
C. Huegeliana, Miq. in Lehm. Pl. Preiss. i. 640 (1846). (*C. Dorrienii.* Domin.)
C. campestris, Diels, in Engler's Botan. Jahrb. xxxv. 126 (1904).
C. Fraseriana, Miq. Rev. Crit. Cas. 59, t. 6d (1848).
C. Baxteriana, Miq. Rev. Cas. 37. t. 3c (1848).
C. bicuspidata, Benth. Fl. Austr. vi. 202 (1873)
C. trichodon, Miq. in Lehm. Pl. Preiss. i. 639 (1845).
C. corniculata, F.v.M. Fragm. x. 62 (1876). (*C. horrida*, Herbert; *C. spinosissima*, Gardn.)
C. decussata, Benth. Fl. Austr. vi. 200 (1873).
C. Decaisneana, F.v.M. Fragm. i. 61 (1858).
C. Helmsii, Ewart et Gordon, in Proc. Roy. Soc. Vict. n. s. xxxii, 192 (1920).
C. humilis, Otto et Dietr. Allg. Garteuz, ix. 163 (1841). (*C. leptotrema*, S. Moore.)
C. Drummondiana, Miq. Rev. Crit. Casuar, xxvi. t. 1d (1848).
C. microstachya, Miq. in Lehm. Pl. Preiss. i 642 (1845).
C. thuyoides, Miq. in Lehm. Pl. Preiss. i. 641 (1845).
C. acuaria, F.v.M., in Journ. Bot. v. 212 (1868).
C. fibrosa, Gardner, in Journ. Roy. Soc. W.A. xiii. 61 (1928).
C. grevilleoides, Diels, in Engler's Botan. Jahrb. xxxv. 130 (1904).

URTICALES.

Ulmaceae.

1. *CELTIS*, (Tourn.) Linn. Gen. ed. I. 337 (1737).
C. philippinensis, Blanco, Fl. Philip. ed. i. 197 (1837).
2. *TREMA*, Lour. Fl. Cochinchin. 562 (1790).
T. aspera, Blume, Mus. Bot. Ludg. Batav. ii. 58 (1851).

Moraceae.

1. *FICUS*, (Tourn.) Linn. Syst. ed. I. (1735).
F. nesophila, Miq. in Ann. Mus. Lugd. Bat. iii. 286 (1867).
F. eugenioides, F.v.M. Docum. Intern. Exhib. 26 (1866).
F. leucotricha, Miq. in Ann. Mus. Lugd. Bat. iii. 285 (1867).
F. puberula, A. Cunn. in Hook. Lond. Journ. vi. 562 (1847).
F. platypoda, A. Cunn. l. c. 561.
F. coronulata, F.v.M. in Journ. Bot. Neerland. 241 (1861).
F. scabra, Forst. f. Prodr. 76 (1786).
F. orbicularis, A. Cunn. in Hook. Lond. Journ. vii. 426 (1848).
F. aculeata, A. Cunn. l. c. 426.
F. scobina, Benth. Fl. Austr. vi. 176 (1873).
F. hispida, Linn. fil. Suppl. 442 (1781).
F. glomerata, Willd. Sp. Pl. iv. 1148 (1806).

Urticaceae.

URTICA, (Tourn.) Linn. Syst. ed. I. (1753).
**U. urens*, Linn. (Cosmop.)

1. *POUZOLSIA*, Gaud. in Freyc. Voy. Bot. 503 (1826).
P. indica, Gaud. in Freyc. Voy. Bot. 503 (1826).

2. *PARIETARIA*, (Tourn.) Linn. Syst. ed. I. (1735).
P. debilis, Forst. fil. Prodr. 73 (1786).

PROTEALES.

Proteaceae.

I.—Persoonioideae.

1. *PERSOONIA*, Smith, in Trans. Linn. Soc. iv. 215 (1798).
P. hakeiformis, Meissn. in Hook. Kew Journ. iv. 185 (1852).
P. teretifolia, R.Br. in Trans. Linn. Soc. x. 160 (1810).
P. saccata, R.Br. Prodr. Suppl. 12 (1830).
P. Saundersiana, Kipp. in Hook. Kew Journ. vii. 72 (1855).
P. diadena, F.v.M. Fragm. x. 46 (1876).
P. comata, Meissn. in Hook. Kew Journ. vii. 71 (1855).
P. brachystylis, F.v.M. Fragm. vi. 221 (1868).
P. falcata, R.Br. in Trans. Linn. Soc. x. 162 (1810).
P. trinervis, Meissn. in Hook. Kew Journ. iv. 185 (1852).
P. tortifolia, Meissn. l. c. 185.
P. angustiflora, Benth, Fl. Austr. v. 386 (1870).
P. rudis, Meissn. in Hook. Kew Journ. iv. 185 (1852).
P. microcarpa, R.Br. in Trans. Linn. Soc. x. 160 (1810).
P. sulcata, Meissn. in Hook. Kew Journ. iv. 185 (1852).
P. acicularis, F.v.M. Fragm. vi. 220 (1868).
P. scabrella, Meissn. in Hook. Kew Journ. vii. 72 (1855).
P. dillwynioides, Meissn. l. c. iv. 185 (1852).
P. striata, R.Br. Prodr. Suppl. 13 (1830).
P. quinquenervis, Hook. Ic. Pl. t. 425 (1842).
P. rufiflora, Meissn, in Hook. Kew Journ. vii. 72 (1855).
P. scabra, R.Br. in Trans. Linn. Soc. x. 162 (1810).
P. graminea, R.Br. l. c. 164.
P. longifolia, R.Br. l. c. 164.
P. articulata, R.Br. l. c. 164.
P. elliptica, R.Br. l. c. 164.
P. leucopogon, S. Moore, in Journ. Linn. Soc. xxxiv. 220 (1898).

2. *FRANKLANDIA*, R.Br. in Trans. Linn. Soc. x. 157 (1810).
F. fucifolia, R.Br. in Trans. Linn. Soc. x. 157 (1810).
F. triaristata, Benth. Fl. Austr. v. 377 (1870).

3. *ISOPOGON*, R.Br. ex Knight, Prot. 93 (1809).
I. latifolius, R.Br. Prodr. Suppl. 8 (1830).
I. cuneatus, R.Br. in Trans. Linn. Soc. x. 73 (1810).
I. linearis, Meissn. in Hook. Kew Journ. vii. 69 (1855).
I. polycephalus, R.Br. in Trans. Linn. Soc. x. 73 (1810).
I. attenuatus, R.Br. l. c. 73.
I. sphaerocephalus, Lindl. Swan Riv. App. 34 (1839).
I. uncinatus, R.Br. Prodr. Suppl. 8 (1830).

I. buxifolius, R.Br. in Trans. Linn. Soc. x. 73 (1810).
I. axillaris, R.Br. l.c. 74.
I tridens, F.v.M. Fragm. vi. 239 (1868).
I. Baxteri, R.Br. Prodr. Suppl. 9 (1830).
I. roseus, Lindl. Bot. Reg. 37 (1842).
I. adenanthoides, Meissn. in Hook. Kew Journ. vii. 69 (1855).
I. trilobus, R.Br. in Trans. Linn. Soc. x. 72 (1810).
I. tripartitus, R.Br. Prodr. Suppl. 8 (1830).
I. longifolius, R.Br. in Trans. Linn. Soc. x. 73 (1810).
I. Drummondii, Benth. Fl. Austr. v. 344 (1870).
I. heterophyllus, Meissn. in Lehm. Pl. Preiss. i. 504 (1844).
I. villosus, Meissn. in Hook. Kew Journ. iv. 183 (1852).
I. alcicornis, Diels, in Engler's Botan. Jahrb. xxxv. 134 (1904).
I. teretifolius, R.Br. in Trans. Linn. Soc. x. 71 (1810).
I. asper, R.Br. Prodr. Suppl. 8 (1830).
I. crithmifolius, F.v.M. Fragm. vi. 239 (1868).
I. formosus, R.Br. in Trans. Linn. Soc. x. 72 (1810). (*I. occidentalis,* Herbert.)
I. divergens, R.Br. Prodr. Suppl. 7 (1830).
I. scabriusculus, Meissn. in Hook. Kew Journ. iv. 182 (1852).

4. ***PETROPHILA,*** R.Br. in Trans. Linn. Soc. x. 67 (1810).
P. teretifolia, R.Br. in Trans. Linn. Soc. x 68 (1810).
P. longifolia, R.Br. Prodr. Suppl. 5 (1830).
P. media R.Br. l. c. 5.
P. acicularis R.Br. in Trans. Linn. Soc. x. 69 (1810).
P. megalostegia F.v.M. Fragm. x 61 (1876).
P. linearis R.Br. Prodr. Suppl. 6 (1830).
P. anceps, R.Br. Prodr. Suppl. 5 (1830).
P. heterophylla, Lindl. Swan Riv. App. 35 (1839).
P. biloba, R.Br. Prodr. Suppl. 7. (1830).
P. propinqua, R.Br. l. c. 7.
P. squamata, R.Br. in Trans. Linn. Soc. x 70 (1810).
P. colorata, Meissn. in Lehm. Pl. Preiss. ii. 246 (1847).
P. striata, R.Br. Prodr. Suppl. 6 (1830).
P. divaricata, R.Br. l. c. 7.
P. serruriae, R.Br. l. c. 6.
P. inconspicua, Meissn. in Hook. Kew Journ. vii. 68 (1855).
P. trifida, R.Br. in Trans. Linn. Soc. x 70 (1810).
P. carduacea, Meissn. in Hook. Kew Journ. iv. 182 (1852).
P. Shuttleworthiana, Meissn. in Lehm. Pl. Preiss. ii. 246 (1847).
P. macrostachya, R.Br. Prodr. Suppl. 7 (1830).
P. diversifolia, R.Br. in Trans Linn. Soc. x 70 (1810).
P. biternata, Meissn. in Hook. Kew Journ. vii. 69 (1855).
P. plumosa, Meissn. l. c. 69.
P. glabriflora, Domin. New Add. Flora W.A. 3 (1923).
P. ericifolia, R.Br. Prodr. Suppl. 5 (1830).
P. scabriuscula, Meissn. in Lehm. Pl. Preiss. i. 495 (1844).
P. chrysantha, Meissn. in Hook. Kew Journ. vii. 68 (1855).
P. fastigiata, R.Br. in Trans. Linn. Soc. x. 76 (1810).
P. seminuda, Lindl. Swan Riv. App. 34 (1839).
P. circinata, Kippist, ex. Meissn. in Hook. Kew Journ. vii. 67 (1855).
P. Drummondii, Meissn. in Lehm. Pl. Preiss. i. 496 (1844).
P. crispata, R.Br. Prodr. Suppl. 6 (1830).
P. rigida, R.Br. in Trans. Linn. Soc. x 69 (1810).
P. conifera, Meissn. in Hook. Kew Journ. vii. 67 (1855).
P. semifurcata, (F.v.M.) Benth. Fl. Austr. v. 335 (1870).
P. incurvata, W. V. Fitzg. in Journ. Bot. 1. 22 (1912).

5. ***ADENANTHOS,*** Labill. Nov. Holl. Pl. sp. i. 28. t. 36 (1804).
A. Detmoldi, F.v.M. Fragm. viii. 149 (1874).
A. barbigera, Lindl. Swan Riv. App. 36 n. 182 (1839). (*A. intermedius,* Ostf.)
A. obovata, Labill. Nov. Holl. Pl. Sp. i. 29. t. 37 (1804).
A. cuneata, Labill. l. c. 28. t. 36.
A. Cunninghamii, Meissn. in Lehm. Pl. Preiss. i. 513 (1845).
A. pungens, Meissn. l. c. 515.

A. venosa, Meissn. in Hook. Kew Journ. iv. 183 (1852).
A. Dobsoni, F.v.M. Fragm. vi. 204 (1868).
A. Forrestii, F.v.M. in Wing's South. Sci. Rec. ii. 230 (1882).
A. linearis, Meissn. in Hook. Kew Journ. iv. 183 (1852).
A. sericea, Labill. Nov. Holl. Pl. Sp. i. 29. t. 33 (1804).
A. cygnorum, Diels, in Engler's Botan. Jahrb. xxxv. 138 (1904).
A. Meissneri, Lehm. in Lehm. Pl. Preiss. i. 512 (1844).
A. filifolia, Benth. Fl. Austr. v. 355 (1810).
A. flavidiflora, F.v.M. Fragm. i. 157 (1859).
A. argyrea, Diels, in Engler's Botan. Jahrb. xxxv. 138 (1904). (*A. intricata*, Gardner).
A. Drummondii, Meissn. in Lehm. Pl. Preiss. i. 514 (1845).
A. apiculata, R.Br. Prodr. Suppl. 9 (1830).

6. *STIRLINGIA*, Endl. Gen. 339 (1838). (*Simsia*, R.Br. 1810.)
S. simplex, Lindl. Swan Riv. App. 30 (1839).
S. abrotonoides, Meissn. in Lehm. Pl. Preiss. i. 517 (1845).
S. teretifolia, Meissn. in l. c. 515.
S. tenuifolia, (R.Br.) Steud. Nom. ed. II. ii. 644 (1821).
S. latifolia, (R.Br.) Steud. l. c. 644.

7. *SYNAPHAEA*, R.Br. in Trans. Linn. Soc. x. 155 (1810).
S. polymorpha, R.Br. in Trans. Linn. Soc. x. 156 (1810).
S. reticulata, (Sm.) Gardner, n. comb. (*S. dilatata*, R.Br.)
S. favosa, R.Br. in Trans. Linn. Soc. x 156 (1810).
S. Preissii, Meissn. in Lehm. Pl. Preiss. i. 529 (1845).
S. acutiloba, Meissn. in l. c. 528.
S. petiolaris, R.Br. in Trans. Linn. Soc. x. 156 (1810).
S. decorticans, Lindl. Swan Riv. App. 32 (1839).
S. pinnata, Lindl. l. c. 32.

8. *CONOSPERMUM*, Smith, in Trans. Linn. Soc. iv. 213 (1798).
C. capitatum, R.Br. in Trans. Linn. Soc. x. 155 (1810).
C. petiolare, R.Br. Prodr. Suppl. 11 (1830).
C. teretifolium, R.Br. in Trans. Linn. Soc. x. 155 (1810).
C. flexuosum, R.Br. Prodr. Suppl. 11 (1830).
C. acerosum, Lindl. Swan Riv. App. 30 (1839).
C. amoenum, Meissn. in Lehm. Pl. Preiss. i. 522 (1845). (*C. Dorrienii*, Domin.)
C. Croniniae, Diels, in Engler's Botan. Jahrb. xxxv 143 (1904).
C. nervosum, Meissn. in Hook. Kew Journ. vii. 71 (1855).
C. diffusum, Benth. Fl. Austr. v. 367 (1870).
C. glumaceum, Lindl. Swan Riv. App. 30 (1839).
C. ephedroides, (Kipp) Meissn. in Hook. Kew Journ. vii. 70 (1855).
C. Todii, F.v.M. Fragm. x. 20 (1876).
C. polycephalum, Meissn. in Lehm. Pl. Preiss. ii. 249 (1847).
C. leianthum, E. Pritzel, in Engler's Jahrb. xxxv. 141 (1904).
C. Etoniae, E. Pritzel, in l. c. 141
C. caeruleum, R.Br. in Trans. Linn. Soc. x. 154 (1810).
C. debile, (Kipp.) Meissn. in Hook. Kew Journ. vii. 70 (1855).
C. scaposum, Benth. Fl. Austr. v. 369 (1870).
C. Huegelii, R.Br. in Endl. Nov. Stirp. Dec. 58 (1839).
C. densiflorum, Lindl. Swan Riv. App. 32 (1839).
C. Brownii, Meissn. in Lehm. Pl. Preiss. ii. 248 (1847).
C. distichum, R.Br. in Trans. Linn. Soc. x. 155 (1810).
C. floribundum, Benth. Fl. Austr. v. 373 (1870).
C. incurvum, Lindl. Swan Riv. App. 30 (1839).
C. brachyphyllum, Lindl. l. c. 31.
C. stoechadis, Endl. in Ann. Wien. Mus. ii. 208 (1838).
C. triplinervium, R.Br. Prodr. Suppl. 11 (1830).
C. bracteosum, Meissn. in Lehm. Pl. Preiss. i. 518 (1845).
C. crassinervium, Meissn. in Hook. Kew Journ. iv. 184 (1852).

II.—Grevilloideae.

9. *GREVILLEA*, R.Br. in Trans. Linn. Soc. x. 167 (1810).
G. pinaster, Meissn. in Hook. Kew Journ. vii. 76 (1855).
G. obtusifolia, Meissn. in Hook. Kew Journ. iv. 187 (1852).

G. sparsiflora, F.v.M. Fragm. vi. 206 (1868).
G. macrostylis, F.v.M. l. c. i. 137 (1859).
G. tripartita, Meissn. in Hook. Kew Journ. iv. 186 (1852).
G. platypoda, F.v.M. Fragm. vi. 205 (1868).
G. patentiloba, F.v.M. l. c. i. 137 (1859).
G. pectinata, R.Br. Prodr. Suppl. 23 (1830).
G. plurijuga, F.v.M. Fragm. iv. 84 (1864).
G. oncogyne, Diels, in Engler's Botan. Jahrb. xxxv. 149 (1904).
G. nudiflora, Meissn. in Hook. Kew Journ. iv. 186 (1852).
G. stenomera, F.v.M. Fragm. iv. 85 (1864).
G. Thelemanniana, Hueg. in Endl. Nov. Stirp. Dec. i. 6 (1839).

Hebegyne, Benth.
G. concinna, R.Br. in Trans. Linn. Soc. x. 172 (1810).
G. Pritzelii, Diels, in Engler's Botan. Jahrb. xxxv. 150 (1904).
G. apiciloba, F.v.M. Fragm. x. 45 (1876).
G. Hookeriana, Meissn. in Lehm. Pl. Preiss. i. 546 (1845).
G. Baxteri, R.Br. Prodr. Suppl. 22 (1830).
G. eriobotrya, F.v.M. Fragm. x. 44 (1876).
G. pterosperma, F.v.M. in Trans. Phil. Soc. Vict. i. 22 (1854).
G. stenobotrya, F.v.M. Fragm. ix. 3 (1875).
G. eriostachya, Lindl. Swan Riv. App. 36 (1839).
G. excelsior, Diels, in Engler's Botan. Jahrb. xxxv. 151 (1904).
G. thyrsoides, Meissn. in Hook. Kew Journ. vii. 77 (1855).
G. chrysodendron, R.Br. in Trans. Linn. Soc. x. 176 (1810).
G. cirsiifolia, Meissn. in Lehm. Pl. Preiss. 258 (1847).
G. bipinnatifida, R.Br. Prodr. Suppl. 23 (1810).
G. armigera, Meissn. in Hook. Kew Journ. iv. 186 (1852).
G. asparagoides, Meissn. l. c. 186.

Plagiopoda, Benth.
G. Treueriana, F.v.M. Fragm. ix. 123 (1875).
G. juncifolia, Hook. in Mitch. Trop. Austr. 341 (1848).
G. Wilsoni, A. Cunn in Wils. Voy. round the World, 273 (1835).
G. erectiloba, F.v.M. Fragm. x. 44 (1876).
G. asteriscosa, Diels, in Engler's Jahrb. xxxv. 151 (1904).
G. insignis, Kippist, ex Meissn. in Hook. Kew Journ. vii. 76 (1855).
G. Brownii, Meissn. in Lehm. Pl. Preiss. i. 537 (1845).
G. crassifolia, Domin, New Add. Fl. W. Austr. 10 (1923).
G. fasciculata, R.Br. Prodr. Suppl. 20 (1830).
G. aspera, R.Br. in Trans. Linn. Soc. x. 172 (1810).
G. brachystylis, Meissn. in Lehm. Pl. Preiss. i. 538 (1845).
G. saccata, Benth. Fl. Austr. v. 450 (1870).
G. Drummondii, Meissn. in Lehm. Pl. Preiss. i. 536 (1845). (*G. pimelioides* W. V. Fitzg.)
G. deflexa F.v.M. in Melb. Chem. p. 72 (1883).
G. disjuncta, F.v.M. Fragm. vi. 206 (1868).
G. Yorkrakinensis, Gardner, in Journ. Roy. Soc. W.A. ix. pt. i. 34 (1923).
G. haplantha, (F.v.M.) Benth. Fl. Austr. v. 451 (1870).
G. extorris, S. Moore, in Journ. Linn. Soc. xxxiv. 221 (1898).
G. pinifolia, Meissn. in Hook. Kew Journ. iv. 186 (1852).
G. acuaria, (F.v.M.) Benth. Fl. Austr. v. 452 (1870).
G. Jamesoniana, W. V. Fitzg. in Proc. Linn. Soc. N.S.W. xxvii. 243 (1904).
G. aculeolata, S. Moore in Journ. Linn. Soc. xxxiv. 222 (1898).
G. pauciflora, R.Br. in Trans. Linn. Soc. x. 174 (1810).
G. cynanchicarpa, Meissn. in Hook. Kew Journ. vii. 75 (1855).

Calothyrsus, Benth.
G. quercifolia, R.Br. Prodr. Suppl. 23 (1830).
G. angulata, R.Br. l. c. 24.
G. Wickhami, Meissn. in Hook. Kew Journ. iv. 186 (1852).
G. agrifolia, A. Cunn. in R.Br. Prodr. Suppl. 24 (1830).
G. Victori, Morrison, in Journ. Bot. l. 276 (1912). (*G. miniata*, W. V. Fitzg.)
G. Cunninghamii, R.Br. Prodr. Suppl. 23 (1830).
G. Huegelii, Meissn. in Lehm. Pl. Preiss. i. 543 (1845).
G. Sarissa, S. Moore, in Journ. Linn. Soc. xxxiv. 222 (1898).
G. dimidiata, F.v.M. Fragm. iii. 146 (1863).

G. heliosperma, R.Br. in Trans. Linn. Soc. x. 176 (1810).
G. refracta, R.Br. l. c. 176.

Cycladenia, Benth.

G. annulifera, F.v.M. Fragm. iv. 85 (1864).
G. leucopteris, Meissn. in Hook. Kew Journ. vii. 76 (1855).

Cycloptera, Benth.

G. pyramidalis, A. Cunn. in R.Br. Prodr. Suppl. 25 (1830). (*G. leucadendron*, A. Cunn.)
G. simulans, A. Morrison, in Journ. Bot. l. 277 (1812).
G. Berryana, Ewart et J. White, in Proc. Roy. Soc. Vict. n. s. xxii. 14 (1909).
G. erythroclada W. V. Fitzg. in Journ. Roy. Soc. W.A. iii. 132 (1918).
G. viscidula, Gardner, in Bull. For. Dep. xxxii. 44 (1923).
G. striata, R.Br. in Trans. Linn. Soc. x. 177 (1810).
G. mimosoides, R.Br. in l. c. 177.
G. latifolia, Gardner, in Bull. For. Dep. xxxii. 43 (1923).

Eriostylis.

G. occidentalis, R.Br. in Trans. Linn. Soc. x. 173 (1810).
G. acerosa, F.v.M. Fragm. i. 136 (1859).
G. umbellulata, Meissn. in Lehm. Pl. Preiss. ii. 252 (1847).
G. pilulifera, (Lindl.) Gardner n. comb. (*G. oxystigma*, Meissn.)
G. uncinulata, Diels, in Engler's Botan. Jahrb. xxxv. 162 (1904). (*G. lycopodina*, S. Moore.)
G. Candolleana, Meissn. in Lehm. Pl. Preiss. i. 541 (1845).
G. scabra, Meissn. in l. c. 541.

Lissostylis.

G. commutata, F.v.M. Fragm. vi. 207 (1868).
G. stenophylla, W. V. Fitzg. in Journ. W.A. Nat. Hist. Soc. ii. 30 (1905).
G. pinnatisecta, (F.v.M.) Benth. Fl. Austr. v. 473 (1870).
G. argyrophylla, Meissn. in Hook. Kew Journ. vii. 75 (1855).
G. brachystachya, Meissn. in Lehm. Pl. Preiss. ii. 254 (1847).
G. Endlicheriana, Meissn. in l. c. i. 546 (1845).
G. Manglesioides, Messn. in. l. c. i. 547. (*G. Loboana, Domin.*)
G. diversifolia, Meissn. in l. c. i. 547.
G. filifolia, Meissn. in l. c. i. 547.
G. hakeoides, Meissn. in l. c. ii. 252 (1847).
G. inconspicua, Diels, in Engler's Botan. Jahrb. xxxv. 153 (1904).
G. teretifolia, Meissn. in Lehm. Pl. Preiss. ii. 255 (1847).
G. eryngioides, Benth. Fl. Austr. v. 476 (1870).
G. bracteosa, Meissn. in Lehm. Pl. Preiss. ii. 254 (1847).
G. crithmifolia, R.Br. Prodr. Suppl. 38 (1830).
G. trachytheca, F.v.M. Fragm. vi. 207 (1868).
G. brachyclada, W. V. Fitzg. in Journ. W.A. Nat. Hist. Soc. ii. 30 (1905).

Conogyne.

G. monticola, Meissn. in Lehm. Pl. Preiss. ii. 259 (1847).
G. Muelleri, Benth. Fl. Austr. v. 479 (1870).
G. trifida, (R.Br.) Meissn. in Lehm. Pl. Preiss. i. 553 (1845).
G. synapheae, R.Br. Prodr. Suppl. 23 (1830).
G. flexuosa, (Lindl.) Meissn. in Lehm. Pl. Preiss. i. 533 (1845).
G. leptobotrya, Meissn. in l. c. ii. 256 (1847).
G. brevicuspis, Meissn. in l. c. ii. 256.
G. intricata, Meissn. in Hook. Kew Journ. vii. 74 (1855).
G. didymobotrya, (Endl.) Meissn. in l. c. iv. 186 (1852).
G. polybotrya, Meissn. in l. c. iv. 185.
G. nematophylla, F.v.M. Fragm. i. 136 (1859).
G. Purdieana, Diels, in Engler's Botan. Jahrb. xxxv. 154 (1904).

Anadenia.

G. paradoxa, F.v.M. Fragm. vi. 246 (1868).
G. petrophiloides, Meissn. in Lehm. Pl. Preiss. ii. 257 (1847).
G. tenuiflora, (Lindl.) Meissn. in l. c. i. 554 (1845).
G. pulchella, (R.Br.) Meissn. in l. c. i. 553.
G. rudis, Meissn. in Hook. Kew Journ. vii. 73 (1855).
G. cordata, Gardner, in Journ. Roy. Soc. W.A. iv. pt. i. 35 (1923).
G. Shuttleworthiana, Meissn. in Lehm. Pl. Preiss. ii. 258 (1847).
G. integrifolia, (Endl.) Meissn. in D. C. Prodr. xiv. 385 (1856).

G. incrassata, Diels, in Engler's Botan. Jahrb. xxxv. 156 (1904).
G. ceratocarpa, Diels in l. c. 157.
G. stenocarpa, (F.v.M.) Benth. Fl. Austr. v. 485 (1870).

Manglesia.

G. acrobotrya, Meissn. in Hook. Kew Journ. vii. 74 (1855).
G. glabrata, (Lindl.) Meissn. in Lehm. Pl. Preiss. i. 549 (1845).
G. ornithopoda, Meissn. in l. c. ii. 256 (1847).
G. paniculata, Meissn. in l. c. i. 550 (1845).
G. biternata, Meissn. in l. c. i. 549.
G. triloba, Meissn. in Hook. Kew Journ. vii. 74 (1855).
G. amplexans, (F.v.M.) Benth. Fl. Austr. v. 488 (1870).
G. vestita, (Endl.) Meissn. in Lehm. Pl. Preiss. i. 548 (1845).
G. tridentifera, (Endl.) Meissn. in l. c. i. 549.
G. phanerophlebia, Diels, in Engler's Jahrb. xxxv. 157 (1904).
G. erinacea, Meissn. in Hook. Kew Journ. vii. 74 (1855).

10. ***HAKEA***, Schrader, Sert. Hannov. 27. t. 17 (1797).

Grevilleoides.

H. chordophylla, F.v.M. in Hook. Kew Journ. ix. 23 (1857).
H. Cunninghamii, R.Br. Prodr. Suppl. 26 (1830).
H. suberea, S. Moore, in Journ. Linn. Soc. xxxiv. 223 (1898).
H. lorea, R.Br. Prodr. Suppl. 25 (1830).
H. macrocarpa, A. Cunn. ex. R.Br. Prodr. Suppl. 30 (1830).
H. arborescens, R.Br. in Trans. Linn. Soc. x. 187 (1810).
H. Morrisoniana, W. V. Fitzg. in Journ. Roy. Soc. W.A. iii. 134 (1918).
H. stenophylla, A. Cunn. ex R.Br. Prodr. Suppl. 30 (1830)

Euhakea.

H. cyclocarpa, Lindl. Swan Riv. App. 36 (1839).
H. crassifolia, Meissn. in Lehm. Pl. Preiss. i. 570 (1845).
H. Brooksiana, F.v.M. in Austr. Journ. Pharm. i. 430 (1886).
H. pandanicarpa, R.Br. Prodr. Suppl. 29 (1830).
H. Roei, Benth. Fl. Austr. v. 499 (1870).
H. adnata, R.Br. Prodr. Suppl. 26 (1830).
H. obliqua, R.Br. in Trans. Linn. Soc. x. 180 (1810).
H. polyanthema, Diels, in Engler's Botan. Jahrb. xxxv. 161 (1904).
H. Hookeriana, Meissn. in Hook. Kew Journ. iv. 208 (1852).
H. incrassata, R.Br. Prodr. Suppl. 29 (1830).
H. flabellifolia, Meissn. in Hook. Kew Journ. vii. 116 (1855).
H. Brownii, Meissn. in Lehm. Pl. Preiss. i. 569 (1845).
H. Baxteri, R.Br. Prodr. Suppl. 28 (1830).
H. ceratophylla, (Sm.) R.Br. in Trans. Linn. Soc. x. 184 (1810).
H. lasiantha, R.Br. Prodr. Suppl. 29 (1830).
H. eriantha, R.Br. l. c. 29
H. megalosperma, Meissn. in Hook. Kew Journ. vii. 177 (1855).
H. clavata, Labill. Nov. Holl. Pl. Sp. i. 31. t. 41 (1804).
H. orthorrhyncha, F.v.M. Fragm. v. 214 (1868).
H. Candolleana, Meissn. in Lehm. Pl. Preiss. ii. 262 (1847).
H. trifurcata, (Sm.) R.Br. in Trans. Linn. Soc. x. 183 (1810).
H. erinacea, Meissn. in Lehm. Pl. Preiss. i. 559 (1845).
H. platysperma, Hook. Ic. Plant. t. 433 (1842).
H. brachyptera, Meissn. in Hook. Kew Journ. iv. 208 (1852).
H. Kippistiana, Meissn. in l. c. vii. 115 (1855).
H. Preissii, Meissn. in Lehm. Pl. Preiss. i. 577 (1845).
H. amplexicaulis, R.Br. in Trans. Linn. Soc. x. 184 (1810).
H. Pritzelli, Diels, in Engler's Botan. Jahrb. xxxv. 163 (1904).
H. prostrata, R.Br. in Trans. Linn. Soc. x. 184 (1810). (*H. glabella*, R.Br.)
H. auriculata, Meissn. in Hook. Kew Journ. vii. 116 (1855).
H. cristata, R.Br. Prodr. Suppl. 28 (1830).
H. linearis, R.Br. in Trans. Linn. Soc. x. 183 (1810).
H. stenocarpoides, (F.v.M.) Benth. Fl. Austr. v. 511 (1870).
H. ruscifolia, Labill. Nov. Holl. Pl. Sp. i. 30. t. 39 (1804).
H. verrucosa, F.v.M. Fragm. v. 25 (1865).
H. rhombalis, F.v.M. l. c. x. 90 (1876).
H. purpurea, Hook. in Mitch. Trop. Austr. 348 (1848).
H. arida, Diels, in Engler's Botan. Jahrb. xxxv. 162 (1904).

H. recurva, Meissn. in Hook. Kew Journ. iv. 207 (1852).
H. circumalata, Meissn. in l. c. vii. 114 (1855).
H. commutata, F.v.M. Fragm. v. 26 (1865).
H. strumosa, Meissn. in Hook. Kew Journ. iv. 208 (1852).

Conogynoides.
H. multilineata, Meissn. in Lehm. Pl. Preiss. ii. 261 (1847).
H. laurina, R.Br. Prodr. Suppl. 29 (1830). (*H. eucalyptoides*, Meissn.)
H. obtusa, Meissn. in Hook. Kew Journ. iv. 209 (1852).
H. cinerea, R.Br. in Trans. Linn. Soc. x. 186 (1810).
H. corymbosa, R.Br. Prodr. Suppl. 28 (1830).
H. undulata, R.Br. in Trans. Linn. Soc. x. 185 (1810).
H. petiolaris, Meissn. in Lehm. Pl. Preiss. i. 577 (1845).
H. neurophylla, Meissn. in Hook. Kew Journ. vii. 117 (1855).
H. loranthifolia, Meissn. in Lehm. Pl. Preiss. i. 574 (1845).
H. cucullata, R.Br. Prodr. Suppl. 30 (1830). (*H. Victoriae*, Drumm.)
H. ferruginea, Sweet, Fl. Austr. t. 45 (1828).
H. smilacifolia, Meissn. in Lehm. Pl. Preiss. i. 567 (1845).
H. elliptica, (Sm.) R.Br. in Trans. Linn. Soc. x. 187 (1810).
H. ambigua, Meissn. in Lehm. Pl. Preiss. ii. 260 (1847).
H. falcata, R.Br. Prodr. Suppl. 29 (1830).
H. pycnoneura, Meissn. in Hook. Kew Journ. vii. 117 (1855).
H. stenocarpa, R.Br. Prodr. Suppl. 29 (1830).
H. marginata, R.Br. in Trans. Linn. Soc. x. 185 (1810).
H. myrtoides, Meissn. in Lehm. Pl. Preiss. i. 577 (1845).
H. costata, Meissn. in l. c. 575.
H. oleifolia, (Sm.) R.Br. in Trans. Linn. Soc. x. 185 (1810).
H. florida, R.Br. in l. c. 183.
H. varia, R.Br. in l. c. 183.
H. dolichostyla, Diels, in Engler's Botan. Jahrb. xxxv. 166 (1904).
H. sulcata, R.Br. in Trans. Linn. Soc. x. 180 (1810).
H. Meissneriana, Kippist ex Meissn. in Hook. Kew Journ. vii. 114 (1855).
H. subsulcata, Meissn. in Lehm. Pl. Preiss. i. 555 (1845).
H. Lehmanniana, Meissn. in l. c. i. 557.

Manglesioides.
H. nitida, R.Br. in Trans. Linn. Soc. x. 184 (1810).
H. Oldfieldii, Benth. Fl. Austr. v. 530 (1870).
H. suaveolens, R.Br. in Trans. Linn. Soc. x. 182 (1810).
H. lissocarpha, R.Br. in Prodr. Suppl. 27 (1830).
H. bipinnatifida, R.Br. l. c. 28.

11. *XYLOMELUM*, Smith, in Trans. Linn. Soc. iv. 214 (1798).
X. occidentale, R.Br. Prodr. Suppl. 31 (1830).
X. angustifolium, Kippist in Hook. Kew Journ. iv. 209 (1852).

12. *LAMBERTIA*, Smith, in Trans. Linn. Soc. iv. 214. t. 20 (1798).
L. uniflora, R.Br. in Trans. Linn. Soc. x. 188 (1810).
L. rariflora, Meissn. in Lehm. Pl. Preiss. ii. 263 (1847).
L. inermis, R.Br. in Trans. Linn. Soc. x. 188 (1810).
L. ericifolia, R.Br. Prodr. Suppl. 30 (1830).
L. multiflora, Lindl. Swan Riv. App. 32 (1839).
L. echinata, R.Br. in Trans. Linn. Soc. x. 189 (1810).
L. ilicifolia, Hook. Ic. Plant. t. 553 (1843).

13. *STENOCARPUS*, R.Br. in Trans. Linn. Soc. x. 201 (1810).
S. salignus, R.Br. in Trans. Linn. Soc. x. 202 (1810).
S. Cunninghamii, R. Br. Prodr. Suppl. 34 (1830).

14. *BANKSIA*, Linn. fil. Suppl. 15 et 126 (1781).
Oncostylis.
B. pulchella, R.Br. in Trans. Linn. Soc. x. 202 (1810).
B. Meissneri, Lehm. in Lehm. Pl. Preiss. i. 582 (1845).
B. nutans, R.Br. in Trans. Linn. Soc. x. 203 (1810).
B. violacea, Gardner, in Journ. Roy. Soc. W.A. xiii. 62 (1927).
B. sphaerocarpa, R.Br. in Trans. Linn. Soc. x. 203 (1810).
B. tricuspis, Meissn. in Hook. Kew Journ. vii. 118 (1855).
B. occidentalis, R.Br. in Trans. Linn. Soc. x. 204 (1810).
B. littoralis, R.Br. in l. c. 204.

B. verticillata, R.Br. in l. c. 207.
B. dryandroides, Baxter in Sweet Hort. Brit. 350 (1827).
B. Brownii, Baxter ex R.Br. Prodr. Suppl. 37 (1830).

Cyrtostylis.
B. attenuata, R.Br. in Trans. Linn. Soc. x. 209 (1810)
B. Elderiana, F.v.M. et Tate, Bot. Centralbl. lv. 317 (1893).
B. media, R.Br. Prodr. Suppl. 35 (1830).
B. audax, Gardner, in Journ. Roy. Soc. W. Austr. xiii. 63 (1927).
B. Solandri, R.Br. Prodr. Suppl. 36 (1830).
B. Goodii, R.Br. l. c. 36.
B. petiolaris, F.v.M. Fragm. iv. 109 (1864).
B. repens, Labill. Voy. i. 412. t. 23 (1798).
B. prostrata, R.Br. Prodr. Suppl. 36 (1830).
B. grandis, Willd. Sp. Pl. i. 535 (1797).
B. quercifolia, R.Br. in Trans. Linn. Soc. x. 210 (1810).
B. Baueri, R.Br. Prodr. Suppl. 35 (1830).

Eubanksia.
B. dentata, Linn. fil. Suppl. 127 (1781).

Orthostylis.
B. coccinea, R.Br. in Trans. Linn. Soc. x. 207 (1810).
B. spectrum, Meissn. in Hook. Kew Journ. vii. 120 (1855).
B. Menziesii, R.Br. Prodr. Suppl. 36 (1830).
B. laevigata, Meissn. in Hook. Kew Journ. iv. 210 (1852).
B. Hookeriana, Meissn. in l. c. vii. 119 (1855).
B. prionotes, Lindl. Swan Riv. App. 34 (1839).
B. Victoriae, Meissn. in Hook. Kew Journ. vii. 119 (1855).
B. speciosa, R.Br. in Trans. Linn. Soc. x. 210 (1810).
B. Baxteri, R.Br. Prodr. Suppl. 36 (1830).
B. praemorsa, Andrews, in Rep. Bot. i. 258 (1802). (*B. marcescens*, R.Br.)
B. Lemanniana, Meissn. in Hook. Kew Journ. iv. 210 (1852).
B. Caleyi, R.Br. Prodr. Suppl. 35 (1830).
B. Lindleyana, Meissn. in Hook. Kew Journ. vii. 120 (1855).
B. elegans, Meissn. in l. c. 119.
B. Candolleana, Meissn. in l. c. 118.

Isostylis.
B. ilicifolia, R.Br. in Trans. Linn. Soc. x. 211 (1810).

15. *DRYANDRA*, R.Br. in Trans. Linn. Soc. x. 211. t. 3 (1810).
D. quercifolia, Meissn. in Hook. Kew Journ. iv. 210 (1852).
D. praemorsa, Meissn. in Lehm. Pl. Preiss. ii. 265 (1847).
D. cuneata, R.Br. in Trans. Linn. Soc. x. 212 (1810).
D. falcata, R.Br. in l. c. 213. (*D. Dorrienii*, Domin.)
D. armata, R.Br. in l. c. 213.
D. longifolia, R.Br. l. c. 215.
D. Fraseri, R.Br. Prodr. Suppl. 39 (1830).
D. floribunda, R.Br. in Trans. Linn. Soc. x. 212 (1810).
D. carduacea, Lindl. Swan Riv. App. 33 (1839).
D. carlinoides, Meissn. in Lehm. Pl. Preiss. ii. 267 (1847).
D. polycephala, Benth. Fl. Austr. v. 570 (1870).
D. Kippistiana, Meissn. in Hook. Kew Journ. vii. 122 (1855).
D. squarrosa, R.Br. Prodr. Suppl. 38 (1830).
D. serra, R.Br. l. c. 38.
D. concinna, R.Br. l. c. 38.
D. foliolata, R.Br. l. c. 38.
D. stupposa, Lindl. Swan Riv. App. 33 (1839).
D. nobilis, Lindl. l. c. 33.
D. mucronulata, R.Br. in Trans. Linn. Soc. x. 213 (1810).
D. formosa, R.Br. l. c. 213. t. 3.
D. Baxteri, R.Br. Prodr. Suppl. 38 (1830).
D. nivea, R.Br. in Trans. Linn. Soc. x. 214 (1810).
D. arctotidis, R.Br. Prodr. Suppl. 39 (1830).
D. nana, Meissn. in Hook. Kew Journ. vii. 121 (1855).
D. Preissii, Meissn. in Lehm. Pl. Preiss. i. 599 (1845).
D. sclerophylla, Meissn. in Hook. Kew Journ. vii. 123 (1855).
D. pulchella, Meissn. in l. c. iv. 211 (1852).

D. plumosa, R.Br. in Trans. Linn. Soc. x. 214 (1810).
D. seneciifolia, R.Br. Prodr. Suppl. 39 (1830).
D. erythrocephala, Gardner, in Journ. Roy. Soc. W. Austr. xiii. 63 (1927).
D. vestita, (Kippist) Meissn. in Hook. Kew Journ. vii. 121 (1855).
D. cirsioides, Meissn. in l. c. iv. 211 (1852).
D. Purdieana, Diels, in Engler's Botan. Jahrb. xxxv. 174 (1904).
D. Gilberti, S. Moore, in Journ. Linn. Soc. xlv. 211 (1920).
D. Hewardiana, Meissn. in Hook. Kew Journ. iv. 210 (1852).
D. patens, Benth. Fl. Austr. v. 578 (1870).
D. conferta, Benth. l. c. 578.
D. horrida, Meissn. in Hook. Kew Journ. iv. 211 (1852).
D. serratuloides, Meissn. in l. c. vii. 123 (1855).
D. comosa, Meissn. in. l. c. iv. 211 (1852).
D. Shuttleworthiana, Meissn. l. c. vii. 122 (1855).
D. speciosa, Meissn. in l. c. iv. 211 (1852).
D. tridentata, Meissn. in l. c. vii. 120 (1855).
D. tenuifolia, R.Br. in Trans. Linn. Soc. x. 215 (1810).
D. proteoides, Lindl. Swan Riv. App. 33 (1839).
D. runcinata, Meissn. in Hook. Kew Journ. iv. 210 (1852).
D. obtusa, R.Br. in Trans. Linn. Soc. x. 214, (1810).
D. bipinnatifida, R.Br. Prodr. Suppl. 39 (1830).
D. pteridifolia, R.Br. in Trans. Linn. Soc. x. 215 (1810).
D. calophylla, R.Br. Prodr. Suppl. 40 (1830).

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